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Railway Age

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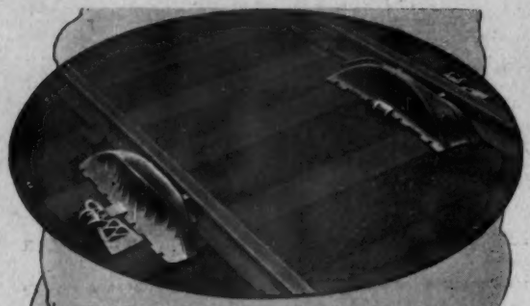

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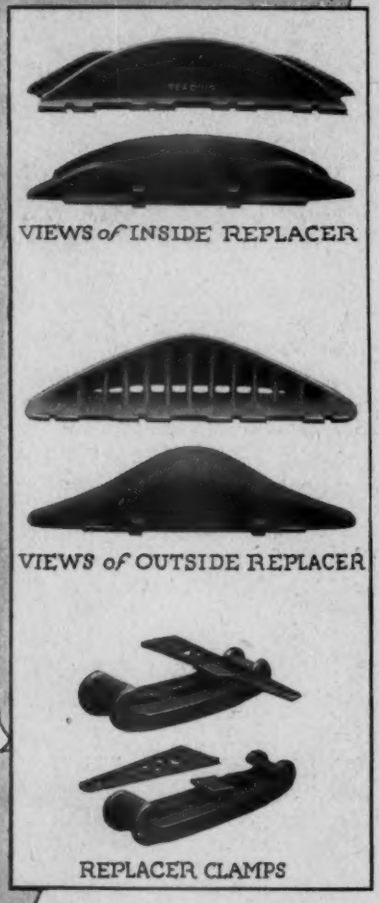

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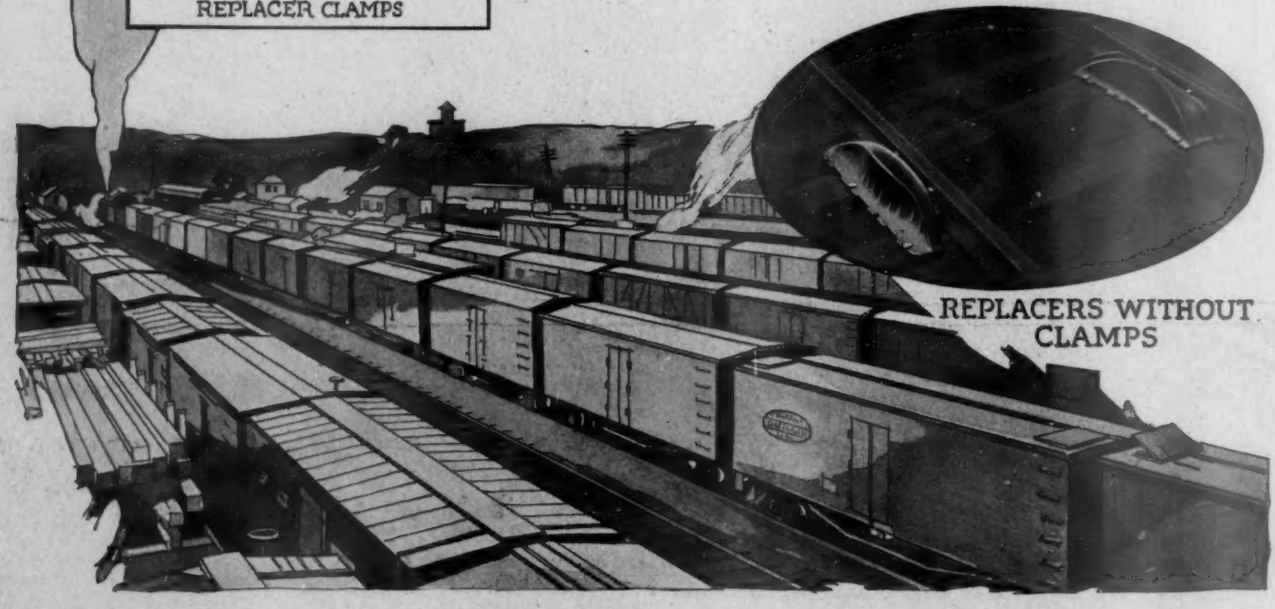

REPLACERS WITHOUT CLAMPS

EDITORIAL

Railway Age

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IMPORTANT FOR SUBSCRIBERS.—*In the interest of the conservation of paper, the Railway Age will print at the end of the present volume only a sufficient number of indexes to meet direct requests from its subscribers. Those desiring indexes should, therefore, immediately advise the New York office, 2201 Woolworth Building, New York.*

Co-Ordinating Motor and Rail Transportation

On a succeeding page in this issue there appears a statement given to the Senate Committee on Interstate Commerce, now engaged in an inquiry into the railroad situation, on the subject of co-ordinating motor transport with rail traffic, by Stuart B. Moore, former construction engineer of the Southern Pacific Lines. This article should be given careful consideration by railroad officers in general for Mr. Moore not only definitely establishes the relation between the economic location of railroads and that of highways but also shows how motor transport can be co-ordinated with rail traffic to the advantage of both. It is undoubtedly true that if a system of highways could be established that by the aid of the motor car would make the distant country districts as available to the city as the territory located close by, rural development would receive a tremendous impetus, rail revenues would be greatly increased and the use of motor vehicles largely extended. Mr. Moore's plan for doing this is well worth the careful consideration of the managers of our railroads, motor car manufacturers and highway engineers.

Organizing for Emergency Work

Emergencies such as the disastrous floods which occurred in various parts of the state of Colorado during the past three weeks, or heavy snow storms such as overwhelmed the railroads in January, 1918, present excellent opportunities for a study of the manner in which the roads organize their efforts to restore the properties to service. Some officers pride themselves on their ability to direct the work first hand and honestly feel that it is their duty to be out on the firing line undergoing hardships shoulder to shoulder with the men taking a direct part in clearing the line for traffic. Other officers find it of advantage to direct the work from temporary headquarters located with a proper consideration for the source of supply as well as the scene of action and make it a point to be present at these headquarters for as large a portion of the time as possible, after having made an inspection which gives them a thorough knowledge of the conditions. Close adherence to this plan insures access to the officer quickly when his advice and decision are necessary. On the other hand, it enables him to have an intimate touch with all the activities that play any part whatever with the strenuous work of restoring a line to service. Consequently, he is able to co-ordinate the various branches of the work so as to expedite progress to the greatest extent. Like a commanding general he is stationed at a sufficient distance behind the firing line to enable him to receive and transmit communications with all portions of the front in the sector under his command, while directing the service of supply, including the forwarding of men, equipment and tools, with a thorough knowledge of the requirements at all points. But of even greater advantage is the effect on the esprit de corps of the subordinate officers, who being placed to a larger extent on their own responsibilities are enabled to put a greater spirit into their work than when the general manager or chief engineer usurps their prerogatives. There are, of course, cases where the executive officer possesses particular talent for the direction of emergency work first hand but as a general rule his particular province lies in the organization of the emergency forces according to a plan under which individual responsibility for the numerous phases of the work are so subdivided that every detail is covered and each man in the entire organization knows just what is expected of him.

The Danger of Delegating Delicate Duties

Colonel J. W. Pringle, senior inspecting officer of railways under the British Ministry of Transport, is the author of a report, just received, on the butting collision of passenger trains near Abermule, Wales, on the Cambrian Railway, January 26, when 17 persons were killed, and he omits mention of what seems at this distance an important underlying cause. The report fills 25 large pages, the disaster being classed as unique in the annals of British railways; but the fact that two of the persons at fault were boys under 18 years of age, not well trained, is not accorded special emphasis, nor is anything said as to why responsible station work was regularly entrusted to persons so young. Before the war, the British train accident reports could for long periods of time be searched in vain for examples of persons under 30 years old performing important duties in connection with train operation or signal working, and the war, depleting the forces and making difficult the recruiting of the ranks with satisfactory material ought, it would seem, to be considered as a cause of this collision; remote perhaps, yet potent. The immediate cause and other particulars will be found in another column. One of the main lessons, applicable everywhere, is the danger of delegating delicate duties. So far as this applies on American railroads, we may translate it as The Importance of Employing Many More and Much Better Inspectors. Many managers have said that the men on the firing line, such as trainmasters and road foremen, ought to be more numerous and more energetic; but to make any appreciable progress, this ought to be said much louder and a good deal oftener.

Electric Power for Traction

The relation of railroad electrification to power supply is now causing much discussion. As much equipment as practicable should, of course, be standardized and it is contended by the advocates of direct current for railroad operation that 60-cycle alternating current, the use of which is increasing rapidly, will some day be universally adopted for power development in this country and that we must look forward to the time when all power for electric traction must be derived from 60-cycle, three-phase alternating cur-

rent feeders. The advocates of alternating current power for traction purposes are naturally opposed to this contention, for 60-cycle power supply involves the use of rotating machinery in the substations of railroads using alternating current on the trolley. Alternating current motors for 60-cycle signed for lower frequencies and if the power for traction is power are not as suitable for railroad traction as those dedeveloped as single-phase power at some lower frequency, such as 15 or 25 cycles, the substations become simple transformer stations. Rotating machinery, or perhaps some form of arc rectifier, is always necessary in substations supplying power to a direct current trolley. Either kind of power for traction may prove to be generally superior to the other but that is still a mooted question.

It is pointed out by F. H. Shepard, director of heavy traction, Westinghouse Electric & Manufacturing Co., in an article in this issue, that it is not desirable to superimpose a variable railroad load on a lighting supply circuit which requires close regulation. To this it might be added that recent experiments indicate that for very high voltage, long distance transmission, it may be found necessary, due to physical difficulties, to develop power at some frequency less the 60 cycles. Advocates of alternating current power for traction lay great stress on the point that sufficient power for heavy and concentrated traffic movements can be supplied only by alternating current. This may prove to be true, but up to the present time direct current power has been able to meet all such demands of load that have been imposed upon it. In other words there are still too many variables involved to warrant curtailing the development of either kind of power for traction. It is highly probable that both kinds will be adopted as they have been in the past, except that the choice will be based more in the future on conditions of traffic and profile instead of being governed by laws and other extraneous influences which had much to do with the selection of equipment for the earlier installations. Railroad operating requirements should be of primary importance and special features of equipment should be subordinated to them.

The Taxes Upon Transportation

WHILE THE TAX SYSTEM of the Federal government is under revision and while there is so much talk about railway rates being too high, Congress and the public might appropriately give consideration to the matter of eliminating taxes on railway freight and passenger transportation.

The tax on freight is 3 per cent of the railway rates and amounted in 1920 to $129,720,000. The tax on passenger traffic is 8 per cent of the railway rates and amounted in 1920 to $103,320,000. This made a total tax that the government added to the railway rates last year of $233,040,000. It is not a part of the rates, and the railways did not get any of it. They merely collected it for the government.

On the basis of the total freight and passenger business handled last year and the higher freight and passenger rates which have been in effect since September 1, 1920, the total annual freight tax would be $148,000,000, and the passenger tax $120,000,000, a total of $268,000,000.

These taxes have exactly the same effect upon the cost of transportation and the movement of traffic as equivalent additions to the freight and passenger rates would have, the only difference being that the money collected goes into the government treasury instead of to the railroads. Certain public officials have expressed the opinion that the present railroad rates are too high and are interfering with the revival of business. If this is true then these taxes upon freight and passenger transportation, which are added to the rates received by the railways, increase this undue burden, and since it is the last straw that breaks the camel's back their removal, on the theory advanced, would be particularly helpful to business. Whether the present rates are or are not burdening business it is obvious that the government cannot consistently reduce a single railway rate on the ground that its reduction is needed to help general business without first removing the transportation tax which is applied upon that rate.

We could not have a better test of the sincerity of the public officials who argue that the present railway rates should be reduced to stimulate business than for them to apply to themselves the position they take regarding the repeal of the transportation taxes. Obviously if the railways are injuring business by charging rates that are too high, then the government is still farther injuring it by adding a tax to these rates. Clearly, it would be more appropriate for the government itself to take off a given tax for the purpose of revivjng general business than it would be for the government to retain that tax and require a private industry such as the railroads to reduce the rates to which the tax is applied, not primarily to help their own business, but primarily to help general business.

Railway Assessments for Permanent Highway Construction

IN VIEW of the widespread movement for the construction of hard surfaced roads throughout the country, a decision handed down by the Supreme Court of the United States on June 6 on a petition presented by the Kansas City Southern and the Texarkana & Fort Smith against a road improvement district in Arkansas, in which the court rejected the assessment levied by the district against the railroad, is of particular interest to railway men throughout the country. In this instance, a road improvement district was created in accordance with an act of the Arkansas legislature, including approximately 25,000 acres having within them 9.7 miles of main track of the Kansas City Southern and the Texarkana & Ft. Smith.

The district was created for the purpose of constructing 11.2 miles of gravel road through taxation upon real property. The assessors divided the farm land into five zones and assessed uniform benefits ranging from $12 per acre in the first zone to $4 per acre in the fifth. The property of the railway was assessed at $7,000 per mile of main track or $67,900 in all. In its petition the railway maintained that this assessment was so excessive as to amount to a confiscation of its property and pointed out that the increased traffic, if any, would be largely or entirely offset by that which was naturally tributary to it, but which could be transported to competing railways over the road in question. It therefore contended that the benefit which would accrue to it as a railway would be negligible. The Supreme Court characterized this assessment as a palpable and arbitrary discrimination and stated that "it is doubtful whether any very substanial appreciation in value of the railroad property within the district will result from the improvement."

The inroads upon railway traffic which are being made by motor transport companies following the construction of hard roads are becoming so serious in certain areas that the Chicago, Rock Island & Pacific filed a protest with the State Public Utilities Commission of Illinois against the use of hard roads by motor bus companies as "an appropriation of public improvements to private interest without any compensation," stating that the operation of a motor bus line parallel to its road will force the railway to curtail its service. That a railway should be forced to meet competition of this character upon a thoroughfare provided by the public and used by competitors without compensation, which is similar in effect to providing a right-of-way complete with tracks

and bridges and turning it over to a competing railway without compensation, is so unfair as to require no argument. To require a railway to contribute to the construction of a highway for its competitor is adding insult to injury. This is the problem which the railways are facing and which they should meet squarely as the Kansas City Southern and the Texarkana & Ft. Smith have done. The decision of the Supreme Court in this case will do much to establish the proper relation between the railways and public authorities charged with the construction of highways.

Wages, Cost of Living and Productive Efficiency

IN THE recent wage hearings before the Railroad Labor Board some of the labor leaders protested against the policy of changing wages according to changes in the cost of living. The American Federation of Labor at its convention in Denver adopted a resolution denouncing the basing of wages wholly or mainly on the cost of living as "a violation of the whole philosophy of progress and civilization and a violation of sound economic theory and thoroughly without logic or scientific support."

Most of the advances in wages which have been made in this country since before the war have been based on increases in the cost of living. This has been especially true in the railroad business. Labor leaders were glad to accept advances in wages based on the cost of living when it was increasing. They repudiate the principle now that the cost of living is declining.

Having secured great advances in wages based on increases in the cost of living, the labor leaders cannot hope to prevent all reductions when it is declining. The cost of living is declining becauses prices are declining. Prices are declining because there is reduced demand for commodities at the high prices which have prevailed. Wages must be reduced when prices sharply decline, because employers cannot pay war wages when they can get only pre-war prices without being bankrupted. In many industries the wages being paid exceed the total earnings of those industries when lower prices and rates were in effect a few years ago. In the railroad industry, for example, the total wages paid in 1920 exceeded the total earnings of 1916. The restoration of pre-war prices means in many industries restoration of pre-war earnings. No industry can pay to labor all it earns.

However, while in a period when prices are falling so much wages must come down, just as in a period when prices are greatly advancing they must go up, the labor leaders are on a sound economic ground when they condemn the practice of basing wages wholly or mainly on the cost of living. A large majority of the people of the world work with their hands. If wages were always to vary directly with the cost of living, the working people never would get for their work an increased amount of comforts and luxuries. This would mean that working people would derive no benefits from the material progress of civilization. If a large majority of the people derived no benefit from it, this so-called "progress" would be misnamed.

Upon what, then, should wages be mainly based? They should be mainly based on productive efficiency. Capital furnishes the directing brains, the physical plant, the tools, of industry. Working people furnish the manual skill and labor. Both should constantly increase their efficiency. The increasing efficiency of both will result in a constantly increasing product in proportion to the capital invested and the number of workers. Equitable division of this increased product would and should result in increasing returns to both.

Increases of industrial efficiency and output will, however, be seriously hindered or prevented if either of the partners in industry, capital and labor, constantly tries to defeat all efforts of the other partner to secure increases of efficiency and output. This is virtually what is being done in many industries now. Capital is constantly trying to increase production in proportion to the amount invested and the men employed. The members of many labor unions, under reactionary leadership, are just as constantly trying to prevent increases of output. These reactionary leaders are sometimes called "radicals." They are, in fact, the most reactionary men in civilized countries. If they should accomplish all they attempt, the efficiency of modern industry would be destroyed and its output so reduced that every workingman's family would suffer curtailment of its comforts and luxuries. These labor leaders restrict the number of brick that men can lay; they insist upon classifications which increase the number of men employed to do a given job; they exhaust their ingenuity in devising ways to curtail not only the number of hours which men work, but the amount each does in each hour he does work. Every measure of this kind tends to reduce the number of houses built, the number of suits of clothes made, the quantity of food produced, the amount of transportation rendered.

No better examples of the results of these labor union tactics could be cited than are afforded by developments in recent years on the railroads of this country. Until 1917 there was a steady increase in the amount of transportation service rendered in proportion to the number of men employed. Since then, while wages have been greatly increased, the output per employee has sharply declined.

In 1913 the amount of public service rendered for each dollar of interest and dividends paid to owners of railway securities was 459 ton-miles and 47 passenger-miles. In 1917 it was 582 ton-miles and 53 passenger-miles. In 1920 it was 611 ton-miles and 64 passenger-miles. The increase between 1913 and 1920 in freight service rendered for each dollar of return paid to capital was 33 per cent and in passenger service 36 per cent. Contrast these statistics with the following regarding the production of transportation to the wages paid: In 1913 for each dollar of wages paid the railroads rendered 245 ton-miles of freight service and 25 miles of passenger service; in 1917, 247 ton-miles and 22 passenger-miles; in 1920, only 121 ton-miles and 13 passenger-miles of service. The decrease in transportation output for each dollar of wages paid between 1913 and 1920 was about 50 per cent.

The *Railway Age* pointed out months ago to labor leaders and their followers that the only way they could hope to retain all, or even a large part, of the advances in wages made since before the war was through increased efficiency. High wages and low efficiency for any considerable time always have been and always will be incompatible in any industry. The labor leaders having, however, obtained rules, hours and working conditions from the Railroad Administration which greatly reduced the efficiency and output of the average employee, sought to perpetuate instead of to eliminate, to aggravate instead of to mitigate, the rules and conditions which produced the demoralization. They sought at the same time to maintain a scale of wages which was incompatible with the gross inefficiency that prevailed. They tried to both eat their cake and have it. The result was to force up railroad rates and at the same time bring the railroads to the verge of bankruptcy. Largely in consequence of these things, 500,000 railway men have speedily found themselves out of employment, and now $400,000,000 of the wage advances has been ordered rescinded.

The labor leaders are right—wages should not be based entirely or mainly on the cost of living. Furthermore, in the long run they cannot and will not be. Efficiency of production always has and always will, in the long run, bring advances in wages largely regardless of the cost of

living. Inefficiency of production always has and always will, in the long run, bring reductions of wages largely regardless of the cost of living. The highest wages in proportion to the cost of living are, and always will be, paid in those countries where the efficiency of capital and labor are the greatest. The lowest wages in proportion to the cost of living are and always will be paid in those countries where the efficiency of capital and labor are the lowest. In the United States wages will increase more than the cost of living in the future as they have in the past if the productive efficiency of capital and labor increases, and decline more than the cost of living if efficiency declines.

Most of the present generation of labor leaders are engaged constantly in trying to reduce wages in proportion to the cost of living by trying to reduce productive efficiency. They may be unconscious of it, but this is what they are doing. Some time, perhaps, the workingmen will choose leaders who recognize not only the truth that wages should not be based on the cost of living, but the additional truth that in the long run they always have been and always must be based upon productive efficiency. The worst enemy the workingman has is the man who exhausts his ingenuity and energy in trying to reduce the amount of efficient work that workingmen do.

Delaware, Lackawanna & Western

THE DELAWARE, LACKAWANNA & WESTERN found the year 1920 a most unsatisfactory one. Its operations in the first four months of 1921 have shown a considerable improvement over those for the similar period of last year, but despite this improvement the road thus far has not been earning its rentals, let alone anything towards its dividend requirements.

The Lackawanna, under the administration of President W. H. Truesdale, has been among the most progressive railroads in the country. It has for many years been conducting an elaborate program of improvements. During the war and the period of federal control, progress on this program was delayed. Despite the unsatisfactory earnings of 1920 and thus far in 1921, this program has been resumed and the road at the present time is carrying out a number of developments, the most important of which is a $4,000,000 project looking to the elimination of grade crossings through the city of East Orange, N. J., and the installation of an additional track to take care of a rapidly increasing suburban service.

The Lackawanna's standard return for the use of the property under federal control was $15,749,477. In 1918 the net operating income exceeded the standard return by a small margin. In 1919, the net railway operating income was $11,947,364, whereas in 1920 it was but $6,104,886. The gross earnings of the company for the year totaled $83,340,062, an increase of $11,516,015 over 1919. The total expenses, however, were $73,840,729, or an increase of $17,775,478. The payrolls for 1920 represent an increase of 117 per cent over the total for 1917. The cost of fuel represents an increase of 50 per cent, or the equivalent of 7 per cent on the capital stock, over 1919. In other words, the story of the Lackawanna's earnings in 1920 is about the same as that for most of the other roads of the country.

Referring briefly to 1921, it is worth noting that the net railway operating income for the first four months of this year, as given in the monthly report to the Interstate Commerce Commission, was $2,227,319, as compared with $305,098 in the same period of 1920. The earnings for the first four months of 1921 were not sufficient to pay the rentals on the Lackawanna's leased lines for the period in question. These total over $7,000,000 a year. Attention should further be drawn to the fact that the Lackawanna is endeavoring to bring its roadway and equipment back to Lackawanna standards. The charges for maintenance of way and structures in the first four months of 1921 were considerably in excess of those for the first four months in 1920. The results as to equipment are best pointed out by the fact that in March, 1921, but 12.4 per cent of the locomotives were classed as unserviceable and but 7.8 per cent of the cars, both of which figures are considerably below the average for the country.

The Delaware, Lackawanna & Western in 1920 carried 28,315,359 tons of revenue freight, aggregating a total ton-mileage of 5,166,315,007; the average haul was 182 miles. This business was considerably in excess of that for 1919, but was not up to the record made in 1917, when 30,477,491 tons of freight were carried. During the year, the road secured an average of 779 net tons per train and of 28.79 tons per loaded car mile, both of which figures were below

The Delaware, Lackawanna & Western

the averages for 1919. The number of passengers carried in 1920 was 30,612,506, an increase of 12.2 per cent over 1919. The average distance hauled per passenger was 123 miles. The average passengers per train mile was 126 and per car mile 37. These figures indicate the predominance of the suburban service, reference to handling of which is given in more detail below.

The operations of the Delaware, Lackawanna & Western are characterized by a number of interesting features. One of these is its financial structure, another is its high standard of maintenance of roadway and equipment and the progressive ideas which the road has shown in connection therewith; a third is contained in the fact that, although the Lackawanna is a hard coal road, about 40 per cent of its traffic being of that commodity, it has no superiors from the standpoint of its efficient handling of merchandise freight. Another interesting feature is the suburban service out of New York and the care which is taken for the comfort and convenience of the suburban passengers.

In so far as concerns the financial aspect but little comment is necessary in this review, for the reason that so much attention was given this subject in connection with the road's application to the Interstate Commerce Commission for permission to capitalize its surplus.* With reference to the standards of maintenance, attention has already been drawn to the efforts the railroad is making to restore its pre-war standards. It is generally known that the Lackawanna's construction standards are of the highest. With reference to the freight service, it may be said that the shippers who

*Covered in the article entitled I. C. C. authorizes Lackawanna stock dividend, *Railway Age* of April 22, 1921, page 995.

use the Lackawanna's rails are outspoken in praise of the service given them.

Attention was drawn above to the fact that the Lackawanna's passenger traffic increased 12 per cent in 1920 over 1919. In 1920 there were carried in and out of the Hoboken station a total of 21,500,000 passengers. This service has been increasing so rapidly in recent years that the Lackawanna has been hard pushed to care for it properly. It has met with difficulties because of inadequate facilities at Hoboken and it has been further handicapped by the failure to come to an agreement with the authorities of the city of East Orange as to the elimination of grade crossings through that community, and it is now meeting a problem in the way of motive power to handle some of its heavier steel suburban trains.

The East Orange difficulty is now by way of solution and work is going on covering the elevation of the line through that community, the work to cost about $4,000,000. In connection with this work, an additional track is to be added, as above noted, which will greatly assist operation during the morning and evening rush hours. The road has been operating its suburban service between West End and Newark over two tracks. Additional facilities will be available when a third track between these points previously used for freight service has been rock-ballasted and made suitable for passenger trains; this work should be completed during the summer.

The motive power situation is still to be met. At present a considerable number of suburban trains are being handled with two superheated, ten-wheel locomotives; the road would presumably use Pacific type locomotives in this service but for the fact that it lacks suitable turntables and roundhouse facilities at the several suburban engine terminals. These facts are brought in to indicate that the Lackawanna has a real problem on its hands in connection with its growing suburban service, the solution of which problems may necessitate the expenditure of large sums of money in the near future.

We quote from the annual report a paragraph dealing with another important improvement which the road has had under consideration for some time and has been taking preliminary steps to carry out, namely, the electrification of the main line between Clarks Summit, Pa., and Gouldsboro, west and east of Scranton, respectively, and about 28 miles apart. The report says:

> In the handling of the company's large coal and other freight traffic over the heavy mountain grades each side of Scranton, many helper or pusher engines are required, which involves the use of a large number of locomotives, at heavy cost, to move the traffic to the top of the mountain grades. Electric experts have given estimates, supported by the experience of other companies that have installed such service for similar purposes, showing that large savings in operating costs can be effected by such installation, and the management is convinced that, under normal conditions of cost as respects labor and materials, the company will be warranted in making the expenditure necessary to provide this improvement.

The operating results for 1920 as compared with 1919 are as follows:

	1920	1919
Mileage operated:		
Coal revenue	$20,228,484	$19,055,523
Freight revenue	40,132,599	32,839,870
Passenger revenue	13,868,517	12,380,787
Total operating revenue	83,340,062	71,824,047
Maintenance of way expenses	10,178,887	7,682,365
Maintenance of equipment	19,508,625	15,132,815
Traffic expenses	1,086,074	495,947
Transportation expenses	40,165,381	30,661,441
General expenses	1,918,854	1,368,205
Total operating expenses	73,840,729	56,065,251
Net revenue from operation	9,499,333	15,758,796
Taxes	3,416,868	3,449,429
Operating income	6,079,655	12,287,412
Net railway operating income	6,104,886	11,947,364

The corporate income account is as follows:

Income from lease of road (1920, 2 months)	$ 3,249,379	$17,324,424
Government advances on guarantee	5,124,500	.....
Total including other	$25,446,520	$25,453,407
Total deductions	$13,675,109	$16,072,200
Less:		
Dividends declared	8,444,110	8,444,455
	$ 5,230,999	$ 7,627,745

New Books

Proceedings of the Telegraph & Telephone Section. Published by the American Railway Association, 75 Church St., New York. 379 pages, 6 in. by 9 in. Bound in cloth.

The book contains the proceedings of the session of the Telegraph and Telephone section, Operating division, American Railway Association, which was held at the Ft. Gary hotel, Winnipeg, Man., September 22, 23 and 24, 1920. The first 33 pages are devoted to the personnel of committees, articles of organization, by-laws and regulations. A discussion of the various reports presented is next given, while the reports, with numerous drawings and several inserts, are presented on pages 154 to 379, inclusive. Reports are presented on construction and maintenance of wood pole lines along railroads; proposed specifications for telegraph, telephone and other signal wire and cable crossings over and under the tracks and wires across the property of steam and electrified railroads; specifications for the installation of telegraph and telephone equipment in railroad offices; protection against electrolysis; specifications for telegraph and telephone line fuses, office arresters and cable arresters; telegraph and telephone instrument fuses; specifications for telegraph and telephone heat coils; report on telegraph and telephone development; traingrams and message classification, semi-automatic sending-keys and theory of inductive interference.

Roadway and Track. By W. F. Rench, formerly supervisor Pennsylvania Railroad. 242 pages, 40 illustrations, 6 in. by 9 in. Bound in cloth. Published by the Simmons-Boardman Publishing Company, Woolworth Building, New York. Price $3.

This book treats of the practical problems arising in the routine maintenance of railway tracks, including such basic items as the renewal of ties, rail, lining and surfacing, etc. It also discusses many of the problems less frequently encountered, such as legal points affecting the right-of-way and means of protecting slopes with vegetation. The book has been written with reference not only to the more elaborate practices on important main lines particularly in the east, but also with due regard for an average maintenance which is applicable to the majority of roads. Labor saving devices have been treated at length throughout the book as has the idea of safety. While the book is of particular value to the foreman and roadmaster, it will be found equally valuable to engineering and operating officers having more or less direct supervision over track work. The methods described are those which have been found practical in the long experience of the author, who was for 25 years a supervisor on the Pennsylvania Railroad, for a large part of which time he was in charge of the maintenance of tracks on its most important multiple track lines.

The book is worthy of a place on the desk of every railway man having direct or indirect responsibility for track maintenance.

Letters to the Editor

One Way That We Can Help Stop the Leak

San Francisco, Cal.

To the Editor:

In combating the loss and damage evil it is evident that a large number of patrons of the railroads make a complete study of the proper means of collecting their claims. The vast sums spent annually in payment of the bill for loss and damage claims illustrate all too well the degree to which they are successful in their study. As a division superintendent, I have always maintained that there should be an O. S. and D., and a loss and damage desk in each superintendent's office to obtain first-hand local information. By means of this loss and damage desk, investigations can be made immediately whenever agents and conductors turn in reports of goods found to be damaged, pilfered, or "short" when the car is opened at an agency station, or is looked over at a loading point.

In spite of this precaution, however, the haste of the local crew, the attention of the agent elsewhere, or carelessness in piling freight in a car, may result in further mishaps. To eliminate as far as possible, this expensive carelessness my assistants, trainmasters and road foremen were required to ride the local trains as often as they could, preaching the gospel that a penny saved is a penny earned. We talked on the same theme at our division safety meetings, at our staff meetings and at our general monthly "get-together" meetings for all employees, and the results which we obtained were more than satisfactory.

One request that I always made of the claim department was that it should inform me of the circumstances before paying a claim of any amount. That this request had a considerable monetary value was shown on a number of occasions.

In one instance, our claim department was about to pay a large claim for a consignment loaded on our lines which was declared to have been received in damaged condition. The bills of lading and the way bills bore no markings and were devoid of any notations. The receiving firm was threatening to sue us in order to collect, but I prevailed upon the claim department to defer payment a few more days. The shipment in question was one of baled cotton and after determining its originating point, I went direct to the merchant who had shipped it.

After a somewhat general discussion of the business situation, I casually asked if he had ever consigned cotton to the A. & B. Cotton Company. He replied that he had, and that they still owed him $2,700, which I recalled was the exact amount of the claim we were holding. I sympathized with him of course, and he in turn, to reward my interest, searched his file and produced a letter from a friend at the point to which the cotton had been shipped. The letter related that the writer had recognized the merchant's mark on a number of bales of cotton lying on their sides and half submerged in water during the frequent hard rains which we were having. I secured a copy of the letter and needless to say, the claim was denied.

To assist the claim department and partly as a result of this investigation, we made it a rule that when exposed cotton was to be loaded from platforms into cars, the way bills and bills of lading should always be endorsed "exposed cotton."

C. W. Hoisington.

The Cost of Train Stops

Chicago

To the Editor:

According to a formula developed by R. E. W. to determine the approximate cost of stopping a train (which was published on page 708 of the *Railway Age* for March 22, 1918), it can be shown that to bring a 50-car freight train to a stop from a speed of 30 miles an hour and for it to again regain that speed is the equivalent of its running 2.4 miles. Again, referring to the Interstate Commerce Commission's report on operating statistics of large steam roads for February, 1921 (appearing on page 1184 of the *Railway Age* for May 20, 1921), an average cost of freight train operation by selected accounts is shown to be $2.11 per mile.

From the above it is readily seen that the railroad assumes a cost of $5.06 for each unnecessary stop made by an average freight train. A considerable saving on freight train operating costs can be secured at many outlying switches by installing electrically operated switch mechanisms and protecting signals. As an example there are many junction points, ends of double track, third track, passing track switches and switches located remotely from existing interlocking plants that are used frequently each day. Not only at such points can the economy of power-operated switch installations be definitely shown, but the increment in safety secured is well worth consideration.

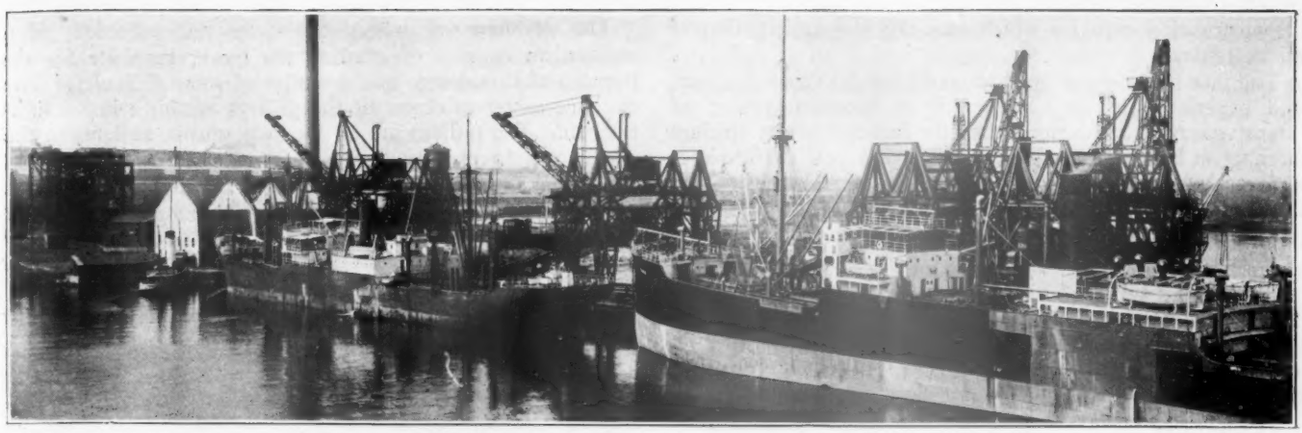
In order to determine the saving made by an installation of electrically operated switch mechanisms at outlying switches we will assume that a saving of $2.53 is made, or only half the cost of a freight train stop as shown above. On a first cost of $6,000 for the installation, allowing 16 2/3 per cent for depreciation or $1,000 per annum and adding $60 per year for the maintenance of one track circuit, one switch movement, and the necessary signals we have a total of $1,060 a year. On this basis it will be seen that 418 train stops, or 1.14 train stops a day at such an outlying switch would pay all charges except that for battery. The cost of battery for operating the switch mechanism has been found to be less than ¼ cent per movement, which is so small as to be negligible. Thus it is seen that the first train which would otherwise have to stop at a switch not equipped with an electrically operated switch mechanism would pay practically all fixed and maintenance charges. If two trains used the same switch each day the second train shows a saving of $2.18, and each succeeding train after the second would show a saving of $2.53.

In a test made under the auspices of the United States Railroad Administration two years ago this month it was found that a tonnage freight train on practically level track made a full stop from 20 miles an hour and again accelerated to 20 miles per hour; in doing this 658 lb. of coal was consumed in addition to that required for the distance run. At $4.61 a ton (I. C. C. cost for February, 1920) this is equivalent to $1.51 worth of extra fuel consumed for the stop. On the basis of economy alone, the desirability of more complete interlocking and signaling has been demonstrated, even assuming that the increment in safety to railway traffic does not warrant the cost of installations at various points.

J. E. S.

The Legislature of Illinois has passed a bill which permits corporations to own not more than 40 acres of land for housing employees. The bill now goes to the governor for his signature.

A Gift of Railroad Passes is reported in the Pittsburgh (Pa.) Post; but the statement does not mean exactly what the reader might expect. The gift does not mean free rides for anybody; it is a collection of seven large scrapbooks, given to the Carnegie Museum by E. H. Utley, vice-president and general manager of the Bessemer & Lake Erie, containing the annual passes which he has accumulated during the last 50 years.



Two Trimmers Working in Hold of Vessel at Curtis Bay

Mechanical Trimmers Facilitate Coal Loading

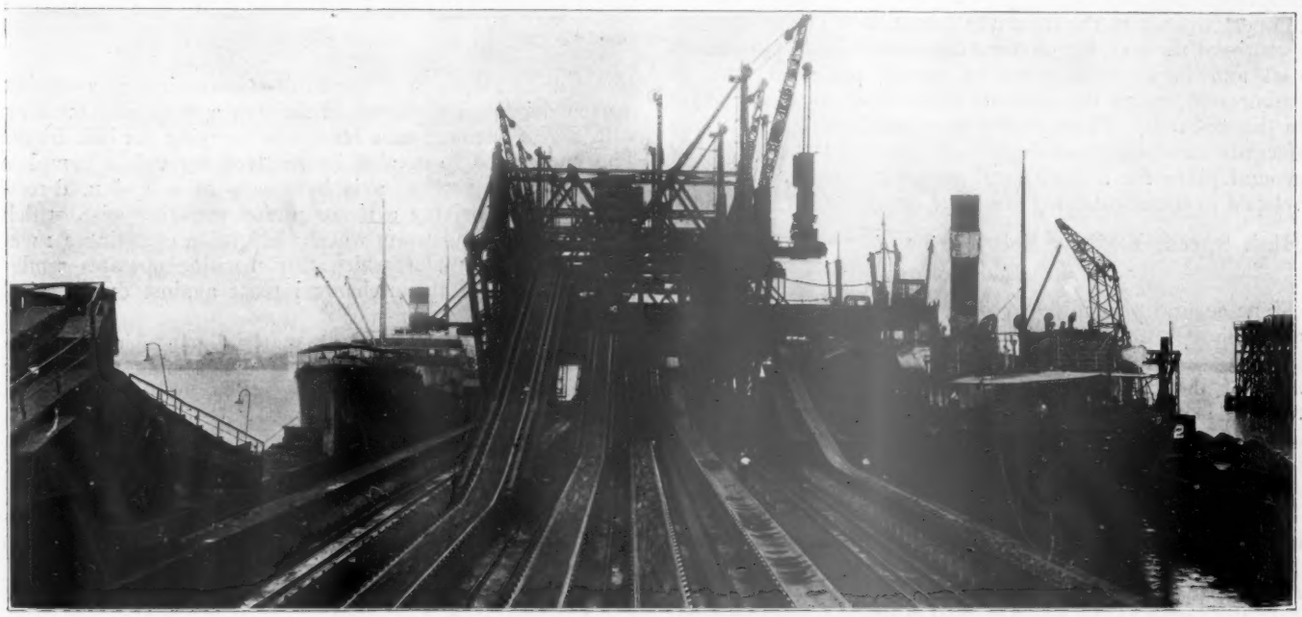
Baltimore & Ohio Installation at Curtis Bay Piers Reduces Time of Turn-Around and Labor Costs

By P. G. Lang, Jr.
Engineer of Bridges, Baltimore & Ohio

EXPORT COAL forms a large and important portion of the American mine-owner's commercial field, and, in itself, creates difficult and unique problems. Prominent among these is that of transferring the coal from railroad equipment to vessels at ocean terminals. One practical solution of these difficulties is represented in the export conveyor-belt coal pier of the Baltimore & Ohio, at Curtis Bay, Md. This was described in detail on page 1226 of the June 15, 1917, issue of the *Railway Age*. A further development of the export coal handling since the construction of this pier, has been made by this road. This consists of the addition of mechanical trimmers which by means of high speed belts distribute the coal at a rate of approximately 25 tons per minute and for distances up to 50 ft. from the device. Four of these trimmers have been installed, making the Curtis Bay pier a very complete and efficient unit for the handling of export coal.

Capacity of Pier Exceptionally Large

This coal pier has the largest capacity of any in the world, and includes mechanical appliances for every operation connected with the removal of bulk coal from open-top railroad equipment and its delivery to the hatches of vessels. This transfer can be effected at a maximum rate of 7,000 tons per hour. These facilities with the exception of the trimmers were placed in operation February 1, 1917, and immediately



A View of the Pier, with Three of the Six Belts in Operation

demonstrated a capacity which exceeded the anticipation of the designers.

The pier has a capacity of about 12,000,000 tons per year, and experience in its use during an extended period of intensive service has demonstrated the fact that a very efficient mechanism had been created for the mechanical performance of every operation incident to the transfer of coal from cars to the holds of vessels, and that, so far as "open" boats were concerned, a complete cycle of mechanical transfer had been established.

The efficiency of this pier as a medium for rapid loading was demonstrated in the case of the New England Coal and Coke Company's ship "Malden," into which there was deposited in 1 hr. 58 min., 7,222 tons of bituminous coal, previously contained in 151 cars.

Trimming by Manual Labor Proves Expensive

In the case of boats whose design embodied numerous small hatches and one or more between decks, a separate operation was necessary for the trimming or distribution of coal after it had been deposited within the hold. For this purpose, the constant employment of large numbers of laborers was necessary, and these men, by the use of shovels, scattered the coal to the remote portions of the hold, which it had failed to reach in its descent from the pier.

The scarcity and high cost of labor during the war period caused the trimming operation to add very materially to the expense of coal movement. It was further productive of extensive delays, both to ships and to the operations of the pier, as the mechanical delivery of coal to the hatches was at a much more rapid rate than its distribution could be effected. Experience at this and other ocean terminals has invariably demonstrated the inability of manual trimming to keep pace with mechanical delivery.

This condition became the object of serious consideration on the part of the railroad management, and, during 1918, extensive studies were undertaken at the Curtis Bay terminals, with a view to evolving some mechanical device capable of supplementing, and, if possible, replacing, manual labor for the performance of the trimming operation. The mechanical features of the pier, the physical characteristics of bituminous coal and the various types of vessels presented may be enumerated among the elements which demanded cognizance in this research. These phases were each considered in their integrity and weighed in their bearing upon each other. The general plans for a mechanical trimmer were gradually developed in the engineering offices of this railroad.

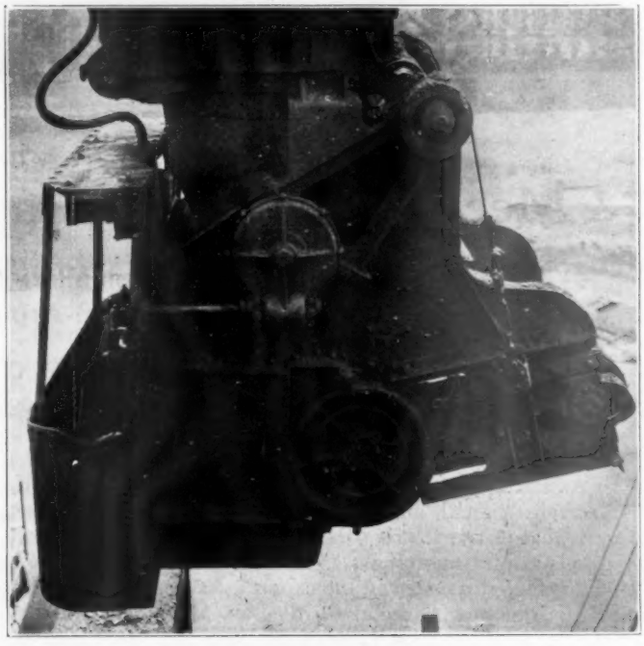
High Speed, Endless Belt Forms Backbone of Trimmer Action

The general principle embodied in this machine is that of an endless belt traveling at high speed over two parallel pulleys or rollers. The coal, in its descent from the shuttle belts of the pier, is direct to and concentrated upon the trimmer belt by means of a telescopic chute. This chute had a maximum cross-sectional area of 2 ft. 9¾ in. by 3 ft. 2¾ in. and can be adjusted as to length from a complete extension of 44 ft. 3 in. to a telescoped condition of 23 ft. 6 in. This attribute, in conjunction with the mechanical characteristics of the pier, renders it possible to adapt the movement of the stream of export coal to practically any of the diverse types of vessels using this pier.

In the design of the trimmer itself, a primary consideration was the necessity for so restricting its dimensions as to permit its introduction within the hatches of vessels, which are, in numerous instances, comparatively small. Extreme dimensions for the trimmer of 7 ft. 6 in. by 10 ft. were finally determined upon, which permitted the introduction of these machines within the hatches of 95 per cent of the ocean-going vessels.

The development, within the space thus afforded, of a mechanism capable of exerting the power requisite for the purpose of this device was a matter of some difficulty. The distance center to center of the pulleys of this trimmer is 3 ft. 9 in. The pulleys are 18 in. in diameter, and, when the machine is in operation, revolve at a speed of 527 r.p.m., imparting to the trimmer belt a speed of 2,700 ft. per min., or approximately 30 mi. per hr. The power for the belt movement is supplied by a 50-h.p. direct-current motor, and is transferred to the driving pulley by a chain drive, protected by a metallic dust cover.

The angle of the trimmer belt with the horizontal may be



Side View of Trimmer, Showing Controls and Controller's Cab

adjusted by means of a mechanism consisting of a ratchet wrench driving a worm wheel through a shaft and meshing with a gear segment on a lever arm carrying the belt frame. The endless belt can also be revolved through a complete circle about a vertical axis by means of a 13-h.p. direct-current motor driving a motor pinion engaging gear, which drives a worm and worm wheel and pinion engaging a rack. The conditions under which this machine operates render the protection of its mechanical parts against dust a vital necessity.

The distance to which bulk material must be thrown in order to fill properly the holds of ocean-going vessels was also carefully considered, and extensive studies were made to determine the range and trajectory of material thrown at various elevations and speeds. The expulsion of the coal with sufficient force to effect its transfer to the remote portions of the hold is accomplished by means of transverse cleats with which the trimmer belt is provided. This trimmer belt has a width of 48 in. The cleats are spaced 6 in. center to center, and consists of strips of belting placed across the trimmer belt and at right angles to its edges. These are secured in place and protected by means of metal clips.

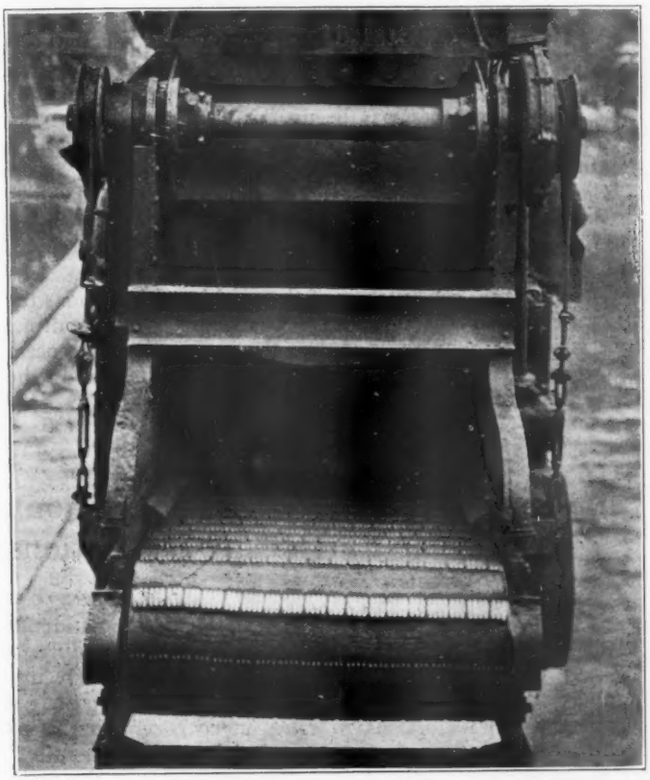
Free Movements of Vessels Necessitates Unusual Method of Support

In order to prevent interference with the free movement of boats alongside of the pier, it is necessary that the trimmer be movable. It is also necessary that it remain steady in heavy winds, be securely attached to the tower and susceptible of

quick adjustment for operating purposes. The weight of each of these machines is about 22 tons, and the method of so attaching them to the pier as to provide for these several conditions was a matter requiring much study and thought.

Each trimmer is supported by means of vertical pipes, which resist the reaction due to the flow of coal, and also the lateral wind pressure. These pipes are suspended by cables from a boom which forms a portion of the loading tower. In the operating position, the weight of the lower portion of the machine is sustained by the boom through the ropes and vertical pipes, while the telescopic chute section is held by brackets placed on top of the cross girders.

Provision is made for the movement of the trimmer from



The Delivery End of the Trimmer, Showing the High Speed Belt

its berth to the end of the ram, whence it can be raised, lowered, carried in and out under the absolute control of the operator located on the end of the ram. All operations are controlled by electric motors and magnetic controllers.

The time required for the movement of the trimmer from the housed position to the operating position in the hatch of a vessel is about 3½ min. The operator's cab is attached to the rear of and forms a part of the machine, which, in its various movements, is accompanied by the operator, who is thus enabled, at all times, to exercise complete control over the stream of coal.

The difficulties encountered in the development of this machine can be appreciated when it is borne in mind that the device is new and original. It was conceived and created by the engineers of the Baltimore & Ohio, for whose guidance in this class of construction no precedents existed.

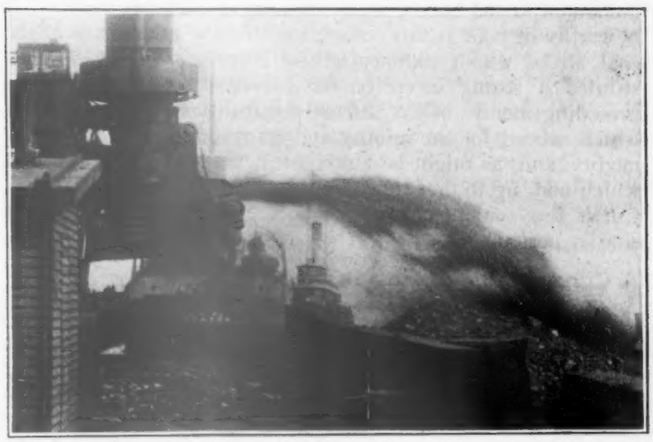
Although the practicability of this machine, its behavior in service, and the trajectory and range of the expelled material are matters which could, by engineering experience or mathematical determination, be forecast, with reasonable certainty, the initiation of the trimmer into service was a matter of some anxiety. In November, 1918, contract was placed for one machine; this order was subsequently increased to four.

The first trimmer successfully trimmed 1,000 tons of petroleum coke in the S. S. "Victorious" during its initial hour of operation. The other trimmers were installed as received at the pier, and the last was put into operation about one year ago.

Machines Show No Deterioration Despite Heavy Service

During the summer of 1920 the volume of export coal business was very heavy, and the Curtis Bay facilities, including the trimmers, were subjected to practically continuous operation. Since the use of these machines was inaugurated, about 4,500,000 tons of coal have passed through them, and been deposited within the holds of vessels. The actual service capacity of each of these four trimmers may be briefly summarized at 25 tons per min., 1,500 tons per hr., and a maximum throw of 50 ft. No perceptible breakage of the trimmed coal has been observed, and no complaints have been received on this account from any source. In spite of the severity and continuity of the demands imposed upon them, these machines have shown no signs of deterioration, and the mechanism of each device is today as serviceable as on the date of its installation.

In considering the remarkable service record of these trimmers, it should be borne in mind that the particles of coal passing over the Curtis Bay pier vary in size from granular consistency to individual lumps attaining a maximum weight of approximately 200 lb. Bulky foreign substances have also found their way into the chute, and been expelled from the trimmers. These articles include a piece of iron, 2 ft. wide, 3 ft. long, weighing approximately 500 lb., large fragments of stone, 500 to 600 lb. in weight, and, on one occasion, a steel car-strut, 8 ft. long, 10 in. wide and 4 in. thick. Although the entrance of such articles into the trimmer chute, and their passage through the machine is an accidental



A Lane-Galloway Trimmer in Action

condition, for the avoidance of which every possible precaution is exercised, the fact that their actual movement and expulsion has, on numerous occasions, occurred without injury to the machines, is an unmistakable demonstration of the soundness of principle embodied in the design of these trimmers and of their rugged construction.

The economic results effected by the use of these machines have, since their initiation into service, been the subject of constant scrutiny and rigid analysis. Their influence upon the operations at the Curtis Bay terminals is clearly illustrated by the following tabulation which appeared in "The Baltimore & Ohio Magazine" for April, 1921.

From comparison of the operating statistics for the months of October, 1919 and 1920, respectively, it will be noted that,

by the use of these trimmers, the capacity of this pier has been practically tripled.

The significance of the figures appearing in this table is not clearly apparent from a cursory examination, and one might easily be led into the error of surmising that the two months mentioned constitute periods of extremely light and extremely heavy traffic, designedly selected for the purpose of magnifying the service rendered by the mechanical trimmers. Careful analysis of the facts set forth will, however, dissipate whatever doubts of this nature may exist. That the two months cited were both periods of heavy traffic is evidenced by the following facts: In October, 1919, before the mechanical trimmers were in existence, the working time of the Curtis Bay export facilities amounted to 579 hours, which, on the basis of a 20-hour working day, then in effect, indicates that the plant was in use 29 days of the 31 in that month. This certainly represents the practical limit of physical endurance, so far as the operating personnel were concerned, even were the mechanical appliances of this pier capable of withstanding, in a satisfactory manner, more continuous service. In October, 1920, when four mechanical trimmers were in use at this pier, 17 hours constituted a working day. The entire working time for the Curtis Bay plant during that month amounted to 463 hours, or 27 days out of a 31-day month. It is worthy of note in this connection that the imminence of the coal strike which commenced on November 1, 1919, constituted a strong incentive for the realization, during the preceding month, of the utmost possibilities of every facility which existed for the mining and transportation of this commodity, and, as might be anticipated, the tonnage handled at which had, up to that time, passed through this terminal in a Curtis Bay coal pier during October, 1919, was the greatest similar period.

COMPARATIVE RECORD, CURTIS BAY CONVEYOR-BELT COAL PIER, BEFORE AND AFTER THE INSTALLATION OF LANE-GALLOWAY MECHANICAL TRIMMERS.

	Without Mechanical Trimmers October, 1919	Four Trimmers Working October, 1920	Percentage Increase
Total tonnage of coal handled during month	266,533	622,097	133%
Total number of cars unloaded	6,003	13,504	125%
Average number of cars handled per working day	207	500	(*)
Average number of tons placed in vessels per working hour	460	1,342	192%

(*) Average working day in 1919—20 hours.
Average working day in 1920—17 hours.

A Considerable Saving Is Made by the Elimination of Hand Trimming

A specific instance of the labor-saving characteristics of this device appears in a recent case, where 9,569 tons of bituminous coal were deposited and trimmed in the hold of a vessel in 9 hr. 33 min. Analysis of this operation indicates that, if hand trimmers had been employed, the labor of 200 men for 25 hours would have been required. The record for October, 1920, when an average of 1,342 tons per working-hour was placed in vessels, is believed to be the world's maximum. It should further be borne in mind that this tonnage was placed in all classes of ocean-going vessels.

The capacity of these trimmers for rapid and intensive service was further demonstrated in October, 1920, when, in 22 hours, 9 vessels and 14 scows were completely loaded with bituminous coal, the coal trimmed in the holds, and work commenced on loading three other vessels. The ships involved in this case were the "Brodin," "Aulmuir," "Isfond," "Bur," "Waage," "Hampden," "Trogu," "Ryage" and "Liberty Bell." The "Sygard" and "Laguasuick" received a part of their load from the 1,082 cars which were dumped in making this record, which is believed to be the world's maximum for rapid handling. A total of 49,630 tons of coal was handled, and this performance is directly attributable to the use of the mechanical trimmers.

An element of prime importance for consideration in connection with the mechanical trimming of coal is that of the service or life obtained from the high speed belts. Belting experts consider that the service which the trimmer belts on these machines must withstand represent the most severe conditions occurring in any field of belt utility. The descent of the coal a distance of 23 to 44 ft. upon the high speed belt, which, moving at the rate of 2,700 ft. per min., hurls the material into distant portions of the vessel's hold, necessarily imposes a severe strain upon this portion of the device, and the development of a type of belt capable of withstanding the needs at this point for an extended period is a matter of some difficulty. Determination of the type of belt most adaptable to the requirements of this service is still the subject of research and experimentation. Many interesting and pertinent facts along this line have been developed since the use of these machines was begun, but investigation has not yet reached such a point as to justify an expression of final opinion concerning this detail.

The appropriation for the necessary studies and the construction of the machines was secured through the efforts of Charles W. Galloway, vice-president in charge of operation and maintenance, Baltimore & Ohio, Baltimore, Md. The development and construction of the machines were under the general charge of H. A. Lane, chief engineer, while the direct supervision of the work, including the preparation of general and detail plans, the construction and installation of the machines devolved upon the writer.

Chairman Clark Deprecates Agitation for Early Rate Reductions

WASHINGTON, D. C.

IN A LETTER to the secretary of the Michigan-Ohio-Indiana Coal Association, Chairman Clark of the Interstate Commerce Commission said he regarded it "as extremely unfortunate that there should have been so much agitation in regard to early reductions in rates on coal, on other commodities, and in some instances on freight traffic generally." "I think that the result of those rumors, which in the main have had no real foundation, has been to stagnate industry and commerce," he said.

"There is not to my knowledge now pending before the commission any formal proceeding in which general reductions of coal rates under Section 1 of the act are sought. There is now pending before us a formal complaint of the Southern Ohio Coal Exchange which alleges undue prejudice against Ohio points and undue preference of mines in the inner and outer Crescent districts. A similar complaint of the Michigan Manufacturers' Association which brings in issue the rates from mines in Ohio and the Crescent groups to destinations in Michigan is also pending. There is also now before the commission for consideration a petition filed in behalf of carriers operating in Ohio, seeking an investigation under section 13 of the act by reason of an alleged preferential adjustment in favor of the intrastate coal traffic. The Michigan case, No. 12,235, has been recently heard, but complaint in the Southern Ohio case, No. 12,698, was not filed until April 13 last and hearing thereon has not yet been had. The cases are brought primarily under sections 2 and 3 of the act. Other minor complaints of an individual character are pending. All are being handled as expeditiously as possible under the considerable pressure of imperative duties. However, I could not undertake to forecast any probable date of decision or to say what the probable effect of our decisions might be."

Employees Win Several Cases Before Labor Board

Pullman Case and Disputes Over Negotiation of Agreements Decided in Favor of Workers

THE DISPUTE over the application of the decision of the Railroad Labor Board abrogating national agreements to the schedules now in effect with the various train service brotherhoods, outlined briefly in the *Railway Age* of June 17 (page 1389), was decided by the Board on June 16 in favor of the employees. In describing the frame of mind which train service employees are now in several of the brotherhood executives, during the progress of the wage reduction hearings, laid great stress on their dissatisfaction over the interpretation of several carriers of Decision 119, which abrogated "the agreements in force under the authority of the United States Railroad Administration." W. S. Carter, president of the Brotherhood of Locomotive Firemen and Enginemen, stated that many roads have interpreted this decision to mean that the schedules held by the train service employees should be abrogated on July 1 and that the employees will "fight ten times as hard against the abrogation of their schedules as they will against a moderate wage cut."

The decision made by the Board in this controversy says in part:

The Labor Board did not, nor could it under the provisions of the Transportation Act, 1920, include in its Decision No. 119 any matter which was not properly before it as a dispute. Decision No. 119 did not, therefore, terminate the existing schedules or agreements of the train, engine and yard employees in the service of the carriers involved. Changes in such schedules or agreements, however, may be made after the required notice either by agreement of the parties or by decision of this Board after conference between the parties and proper reference in accordance with the provisions of the Transportation Act and the rules of the Board.

Pullman Company Loses Case

The controversy between the Pullman Company and its shop employees, which was described briefly in the *Railway Age* of June 10 (page 1336) and of June 17 (page 1390), was also decided by the Board in favor of the employees, the Board's ruling being dated June 17 and designated as Decision No. 174.

After outlining the question in dispute and the history of the controversy, the Labor Board said:

The Labor Board held in Decision No. 119 that the presentation of irreducible demands without a genuine attempt to negotiate a settlement was not in compliance with Section 301 of the Transportation Act, 1920. So far as the evidence shows in this case, representatives of the Pullman Company had no authority further than to ask the employees to accept or reject one proposition.

Furthermore, the carrier takes the stand that it is optional with the carrier, when a dispute arises between itself and its employees, whether or not to confer with the employees directly or with their representatives. In this case, the carrier has elected to meet with the employees and has wholly ignored the respondent organization which claims to represent a majority of the Pullman Company employees directly interested in the dispute.

In taking this course, the Pullman Company contends that the question whether conferences have been held, also whether the respective parties have used every possible means to avoid interruption to traffic, is purely technical.

In Order No. 1 of April 19, 1920, Announcement of December 17, 1920, and various decisions, the Labor Board has clearly set forth its views that parties shall exert every effort to avoid interruption to traffic, that it is the duty of officers of the carrier to confer or attempt to confer with the representatives of the employees, and that these preliminaries are not technicalities but prerequisite to a hearing.

The decision in the case is as follows:

The letter and spirit of Section 301 of the Transportation Act, 1920, have not been complied with by the carrier. The act will not have been complied with until the carrier shall have met in conference or endeavored to meet in conference the duly designated representatives of the employees directly interested in the dispute, and, in case of disagreement, shall have properly certified the dispute to the Labor Board.

The majority of said employees shall have the right to select their said representatives as provided in Principle 15, Decision No. 119.

Application is therefore dismissed.

Employees Win Another Point

Another significant decision was rendered by the Board in a dispute between the Missouri, Kansas & Texas and the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees. The question in dispute was, in general, whether or not an agreement covering rules and working conditions of the employees of a carrier be made directly with the employees or with an organization representing the employees. The carrier contended that it was its duty to make an agreement with the employees concerned and not with an organization. Representatives of the carrier conceded that the brotherhood represented a majority of that class of its employees, but declined to permit the caption of the proposed agreement to show that the employees covered by the agreement were represented by this organization. The carrier also objected to the caption offered by the organization on the ground that by its terms it would not include the employees not members of the organization and would result in a "closed shop" on that property. The organization contended that it had the right to make an agreement covering all employees and stated that it was not the desire of the organization to negotiate an agreement that did not cover non-members as well as members of the organization.

The decision of the Board in this case is as follows:

The following language of Decision No. 119 bears upon this controversy:

"The majority of any craft or class of employees shall have the right to determine what organization shall represent members of such craft or class. Such organization shall have the right to make an agreement which shall apply to all employees in such craft or class."

It is, therefore, clear that said organization has the right to make an agreement as to rules and working conditions for said entire class of employees of said carriers, both members and non-members of said organization, and it is proper that the caption be so drawn as to show for whom and by whom the agreement is made, and the Labor Board so directs.

In order that there may be no misunderstanding as to the matter in dispute the Labor Board directs that the caption of said agreement shall be as follows:

Missouri, Kansas & Texas Railway
Missouri, Kansas & Texas Railway of Texas
Wichita Falls & Northwestern Railway
C. E. Schaff, Receiver.

AGREEMENT
between
C. E. Schaff, Receiver,
and all that class of clerks and other office and station employees, represented by the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees.

American Railway Express Company Asks for Wage Reduction

The American Railway Express Company appeared before the Board on June 17 and through L. R. Gwyn, chairman of the company's board of wages and working conditions, requested that the wage increases granted by the Railroad La-

bor Board last July be wiped out. In support of the request Mr. Gwyn submitted numerous exhibits which showed that the ratio of wages to revenue increased from 26.15 per cent in 1915 to 41.53 per cent in 1920 and to 52.78 per cent in January, 1921. The ratio of wages to operating expenses he showed to be 57.7 per cent in October, 1919, rising to 68.4 per cent in February, 1921. The average wage of all employees of the company increased from $71.33 in December, 1917, to $138.54 in March, 1921, Mr. Gwyn testified.

The employees' arguments were presented by E. H. Fitzgerald, president of the clerks' organization. Mr. Fitzgerald, in defending the present wage scales, stated that there has been a marked increase in the efficiency of the express employees, pointing to a decrease of 49 per cent last year in claims against the company as proof of this increased efficiency. Mr. Fitzgerald also contended that the expressman's work was hazardous in that it exposed him to diseases in handling shipments and to death at the hands of bandits. The case was closed on the same day and taken under advisement by the Board.

More Railroads Ask for Wage Reductions

A hearing was held on June 20 at which approximately thirty carriers presented pleas to the Board for wage reductions for various classes of employees which they had not included in previous presentations. Among those which appeared before the Board for the first time in this case was the Southern and its subsidiary lines. The evidence presented at this hearing was largely a repetition of the evidence which has already been presented in the case and the roads involved will be included in the forthcoming decision.

New Rules Governing Equalization Accounts Issued by I. C. C.

NEW RULES governing the equalization of operating expenses have been issued by Division IV of the Interstate Commerce Commission. The new rules supersede section 19 of the special instructions now appearing on page 37 of the Classification of Operating Revenues and Operating Expenses of Steam Roads, Issue of 1914, and add two new sections, namely, Account 280, "Equalization—Way and Structures," and Account 338, "Equalization—Equipment." They are effective as of January 1, 1921, and are as follows:

It is ordered, That section 19 of the special instructions as it now appears on page 37 of the classification of Operating Revenues and Operating Expenses of Steam Roads, Issue of 1914, is hereby cancelled, and the following is prescribed as section 19 of the special instructions:

19. EQUALIZATION OF EXPENSES.—When carriers adopt a budget or estimate of expenditures for maintenance of fixed improvements or equipment for the year, such authorized estimates may be equalized by division into twelve equal parts, if for a full year, or into a number of equal parts corresponding to the number of months remaining in the year after the adoption of the maintenance program. If advantage is taken of the optional accounting prescribed in this section, the appropriate primary accounts chargeable with the actual expenditures and the equalization account combined shall contain, each month, amounts aggregating one of such equal parts.

Adequate records shall be kept to fully support the estimates for expenditures for maintenance which form the basis of entries to accounts 280, "Equalization—Way and Structures," and 338, "Equalization—Equipment," and these records shall be filed in such manner as to be readily accessible for examination by representatives of the Interstate Commerce Commission. The equalization accounts are provided in order that their use may show, for each month, the adjustment necessary between actual expenditures included in the other primary accounts and the equal monthly proportion of the estimated or authorized maintenance expenses for the period.

If the actual monthly expenditures do not aggregate a sum equivalent to the equal monthly proportion of the estimated cost of maintaining such way and structures and equipment as are provided for in the budget, an amount sufficient to make up the difference shall be charged to the appropriate equalization account. If the actual expenditures are more than the equal monthly proportion of the estimate, the difference shall be credited to the equalization account. Concurrently, a credit, or debit, as may be appropriate, shall be made to a ledger account styled, "Equalization reserve—Way and Structures," or "Equalization reserve—Equipment," classable under account 727, "Other unadjusted debits," if the balance be a debit, or account 778, "Other unadjusted credits," if the balance be a credit.

The accounts, "Equalization reserve—Way and Structures," and "Equalization reserve—Equipment," shall be cleared annually unless at the close of the year a credit balance remains therein due to the non-completion of maintenance work because of adverse labor conditions, non-receipt of material, or similar reasons, in which case such part of the balance as is applicable to unfinished work may be carried over to the following year. The carrier shall indicate in its annual report to the Commission the amounts constituting such balance and the reasons therefor. Under no circumstances shall a debit balance be carried over the year. Where a credit balance is carried forward it shall be shown separately as one of the items comprising the detail of account 778 in the schedule provided therefor. Balances in reserve accounts carried forward to the succeeding year shall not be merged with equalization reserves for the subsequent period. The equalization accounts for each year shall be kept separate.

Carriers desiring to make use of the equalization accounts shall file with the Bureau of Accounts of the Commission, each year, before making use of them, a statement of the maintenance program which is to be equalized in the accounts of that year. If conditions arise which necessitate changes in the maintenance program involving changes in the equal monthly charges to operating expenses, a full statement of the facts as to the changes shall be filed with the Commission not later than thirty days after the changes are made.

Estimates of expenses, other than under general accounts I and II, on account of personal injury or loss and damage liability, for stationery and printing, and for advertising, may be equalized in the monthly accounts for the year by use of the regular primary accounts. If, on account of claims for personal injury or loss and damage being unsettled at the close of the year, the accounts for such expenses are not adjusted, the balances carried forward in the operating reserve account shall be analyzed as provided for in section 20 of these instructions.

Charges for stationery and printing, and for advertising, for a fiscal year shall be adjusted to the actual expenses.

It is further ordered, That accounts 280, "Equalization—Way and Structures," and 338, "Equalization—Equipment," with the texts pertaining thereto, as follows, be prescribed as a part of the Classification of Operating Revenues and Operating Expenses of Steam Roads, Issue of 1914:

Account 280 "EQUALIZATION—WAY AND STRUCTURE."

This account, the use of which is optional, shall include an adjustment of the monthly proportion of the estimated or authorized maintenance expenses for the year, as provided for in section 19 of the special instructions, the amount included herein being the difference between actual expenditures as reflected in other primary accounts under this general account, and the equal monthly proportion of the estimate for the period. Concurrently, a credit, or debit, as may be appropriate, shall be made to a ledged account styled, "Equalization reserve—Way and Structures."

Account 338, "EQUALIZATION—EQUIPMENT."

This account, the use of which is optional, shall include an adjustment of the monthly proportion of the estimated or authorized maintenance expenses for the year, as provided for in section 19 of the special instructions, the amount included herein being the difference between actual expenditures as reflected in other primary accounts under this general account, and the equal monthly proportion of the estimate for the period. Concurrently, a credit, or debit, as may be appropriate, shall be made to a ledger account styled, "Equalization reserve—Equipment."

Employees and Their Compensation

THE INTERSTATE COMMERCE COMMISSION'S quarterly statistical report on the number, service and compensation of steam railroad employees (class I roads) shows a reduction of $38,000,000 in the payroll during the first three months of 1921 as compared with the corresponding quarter of 1920 in spite of the increase in wages. The report shows a decrease of 302,053 in the number of employees for the quarter and a decrease of 416,880 for the month of March as compared with March last year. The total compensation for the quarter was $757,000,000 as compared with $795,000,000 for the first quarter of 1920. For the year ending with March 31, 1921, which includes only one month at the old rates of pay and 11 months on the basis of the increased wages made effective as of May 1, 1920, the payroll would appear from the reports to have been $3,695,000,000. This includes $801,000,000 for the second quarter of 1920 on the old basis, $102,000,000 as the commission's estimate for the May and June back pay, $1,052,000,000 for the third quarter of 1920 on the new basis, $982,000,000 for the fourth quarter on the new basis, and $757,000,000 for the first quarter of 1921 on the new basis. The commission's report showed $3,733,000,000 as the payroll for 1920 for Class I roads. The commission's summary of its report for the first quarter of 1921 is as follows:

Item.	1921	1920	Decrease	Per cent of decrease
Average number of employees:				
January	1,804,822	2,000,105	195,283	9.76
February	1,676,543	1,970,525	293,982	14.92
March	1,593,068	2,009,948	416,880	20.74
First quarter ...	1,691,471	1,993,524	302,053	15.15
Compensation:				
First quarter ...	$757,325,356	$795,616,330	$38,290,974	4.81

Annual Meeting of the A. S. T. M. at Asbury Park

An Abstract of the Reports and Papers Presented Which Are of General Interest to Railway Men

THE ANNUAL MEETING of the American Society for Testing Materials was held this year, as it was in 1920, at the New Monterey Hotey, Asbury Park, N. J., on June 20 to 24, inclusive. The following officers were elected for the coming year: C. D. Young, president; Guilliaem Aertsen, vice-president, and F. R. Baxter, E. D. Boyer, F. M. Farmer and W. H. Fulweiler, members of the executive committee.

The joint committee of the American Society for Testing Materials, the American Society of Civil Engineers, the American Railway Engineering Association, the American Concrete Institute and the Portland Cement Association presented its progress report on standard specifications for concrete and reinforced concrete in the form of tentative specifications for the same. According to the method with which this is being handled, the initial report of the joint committee will be submitted to each of the five societies as a tentative report after which it will be referred to the committee for revision.

The following is an abstract of some of the reports and papers presented before the convention:

Some Failures of Cast-Iron Wheels

By H. J. Force

Chemist and Engineer of Tests, D. L. & W.

TABLE I—WHEELS WORN OUT IN SERVICE

(All values in per cent)

Mark	Cast	Total carbon	Graphitic carbon	Combined carbon	Phosphorus	Sulfur	Manganese	Silicon
A.....	9-20-15	3.31	2.32	0.99	0.360	0.154	0.49	0.70
B.....	6- 2-16	3.53	2.77	0.75	0.308	0.136	0.66	0.73
C.....	7- 2-13	3.17	2.18	0.98	0.304	0.155	0.55	0.65
D.....	8-24-12	3.08	2.15	0.93	0.260	0.122	0.43	0.59

It is well known that during the past few years railway cars have been loaded to greater capacity; heavier equipment has been placed on many lines; many roads are using rails much heavier than a few years ago; roadways are rock ballasted, and are very largely equipped with tie plates. This rigid track construction has placed a greater duty upon the chilled-iron wheel, a condition which it is felt the manufacturers possibly have not realized, for little or no effort has been made to improve the quality of the wheels to meet these severe conditions.

The cast-iron wheel is about the only part of railway equipment which is not purchased to a chemical specification; yet it is the most important part of such equipment. Such chemical specifications, as have been recommended, are not generally acceptable both to the manufacturer and the consumer. It is generally conceded that unless an improvement is made in the quality of cast-iron wheels, the railway lines will be forced to give careful consideration to the use of steel wheels, with the hope that fewer failures will result in service. From a study of the service condition of cast-iron wheels, we are of the opinion that this wheel can be greatly improved, and that it will be found to be satisfactory under nearly all equipment.

Four wheels were selected from a number of wheels which had been worn out and marked A, B, C, and D. Table I shows the date each wheel was cast, and gives the composition. It will be noted that in most cases these wheels meet the requirements of the specifications recommended later, although no effort apparently was made to make the wheels to any specification. The table shows the fact that the composition as to phosphorus and sulfur, and especially silicon, is fairly satisfactory. It should also be pointed out that the wheel with the lowest sulfur and lowest phosphorus apparently gave the best service. The higher silicon wheels in all cases showed more wear than lower silicon wheels. On the other hand it is believed that the combined carbon content, which in one case is as high as 0.99 per cent, is outside the limit for a cast-iron wheel which would give the best service.

Table II shows a list of wheels which failed in service and in each case caused a serious derailment. Note here the high combined carbon, high phosphorus and uniformly high sulfur, in some cases low manganese, and in many cases high silicon. Wheels of this composition should not, under any circumstance, be placed in service.

TABLE II—WHEELS FAILED IN SERVICE

(All values in per cent)

Mark	Cast	Total carbon	Graphitic carbon	Combined carbon	Phosphorus	Sulfur	Manganese	Silicon
1....	8-27-17	3.24	2.24	1.01	0.420	0.176	0.57	0.70
2....	.....	3.36	2.13	1.23	0.430	0.191	0.41	0.82
3....	.....	3.35	2.46	0.89	0.440	0.200	0.65	1.06
4....	4-15-18	3.37	1.87	1.50	0.384	0.182	0.39	0.75
5....	5-28-13	3.34	2.19	1.14	0.388	0.199	0.52	0.75
6....	3-28-18	3.34	2.10	1.24	0.386	0.146	0.36	0.76
7....	6-28-20	3.22	1.91	1.31	0.354	0.193	0.52	0.80
8....	8-21-19	3.20	1.99	1.21	0.384	0.261	0.67	0.88
9....	3-14-18	3.19	2.24	0.95	0.364	0.171	0.50	0.84
10....	3- 9-20	3.34	2.15	1.19	0.428	0.185	0.52	0.69
11....	10-13-17	3.19	2.16	1.03	0.408	0.138	0.38	0.70
12....	9- 3-19	3.33	2.24	1.08	0.370	0.197	0.60	0.76
13....	12-30-18	3.32	2.34	0.98	0.420	0.175	0.79	0.73
14....	.....	3.12	2.14	0.98	0.420	0.219	0.72	0.93
15....	2-17-15	3.32	2.20	1.12	0.400	0.190	0.43	0.68

It is not contended that a chemical requirement will at once eliminate all wheel failures, for it is possible that an occasional wheel will fail in service from inferior composition due possibly to some oversight on the part of a workman in the foundry. The cracking of plates is due very largely to inferior chemical composition. Seamy rims and seamy treads are as a rule due to foundry practice, and are usually the result of metal being poured at too low a temperature. It is hardly necessary to call the attention of the manufacturer to the necessity of immediate improvement in both manufacture and composition of cast-iron wheels.

The following specification is therefore recommended to cover all weights of chilled iron wheels:

SPECIFICATION "A"

Total carbon, per cent	3.00 to 3.65
Combined carbon, per cent	0.45 to 0.85
Manganese, per cent	0.50 to 0.75
Phosphorus, per cent	Not over 0.32
Sulfur, per cent	Not over 0.17
Silicon, per cent	0.45 to 0.75

It is felt that the heavier wheels which are now being recommended will have a further tendency to reduce failures.

It is recommended that special consideration be given to a wheel which contains a small percentage of nickel and chromium, as indicated in specification "B." Wherever wheels of this composition have been placed in service, the results have been highly satisfactory; and the wheels should be especially suitable for the heavier equipment. The increased cost of these special wheels will run from seven to ten per cent.

SPECIFICATION "B"

Total carbon, per cent	3.20 to 3.75
Combined carbon, per cent	0.40 to 0.80
Manganese, per cent	0.45 to 0.65
Phosphorus, per cent	Not over 0.15
Sulfur, per cent	Not over 0.17
Silicon, per cent	0.45 to 0.70
Chromium, per cent	0.10 to 0.25
Nickel, per cent	0.10 to 0.20

The majority of the failures of wheels previously cited occurred near the bottom of long, heavy grades, probably due to the elevated temperatures which the wheels attained.

In nearly all cases failure occurred by rupture of the plate, and it is important, therefore, that the composition be controlled so that as much strength as possible may be obtained and the wheel enabled to withstand the elevated temperatures developed on all heavy grades.

Phosphorus and Sulphur Note in Specifications

The committee, on steel, after careful consideration of the note concerning phosphorus and sulphur, which by action at the last convention was allowed to remain on 14 specifications, recommended that this note be removed from all specifications and that the sulphur requirement be raised 0.01 per cent in four specifications, and the phosphorus requirement for acid steel be raised 0.01 per cent in one specification.

In explanation of these recommendations it was pointed out that of the 14 specifications which now carry the note, the note affects the phosphorus in Bessemer steel in the specifications for rails, splice bars, reinforcement bars, tie plates, track bolts, and the Bessemer grade in structural steel for buildings. The recommendation to remove the note from these specifications will require manufacturers to work to the original phosphorus limit for Bessemer steels.

Of the remaining specifications, three cover rivet steel, original sulphur 0.045 per cent; also the specifications for boiler tubes and seamless tubes call for sulphur 0.045 per cent. The effect of this recommendation would be to require manufacturers to adhere to the original 0.045 limit. Sulphur for steel chain is specified at 0.05 per cent and this would again become the limit.

As against these changes cutting off the extension for sulphur and phosphorus, it was felt the extension in sulphur from 0.05 to 0.06 per cent in the three classes of structural steel must be retained due to the heavy tonnages involved, and to the continued difficulty in obtaining low-sulphur fuels and melting stock.

Interpretation of Timber Tests

The committee on timber reported that much confusion arises by various people attempting to use the data in ways that were never intended. This is especially true when they undertake to compare species on the basis of existing structural timber tests. The information is of exceeding great value in formulating grading rules, in determining the influence of defects and in getting the relation between the strength of large and small pieces, but the absolute values do not and can not represent the average strength of any grade of material of the species, as that average value is continually shifting, due largely to manufacturing conditions which at one time will throw into a grade timber of a high quality and at another time changes in demand will cause the same grade to carry a maximum of the poorest stock that will pass. This difficulty is also aggravated by the fact that most of the commercial grades now in use are not based on the size and distribution of defects such as insure any standard strength. It must also be considered that the tests made with the center load will always average higher for the same grade of material than the tests made with the two loads, since with the two loads the knots and other defects have a greater influence.

Two rather comprehensive tables have been published as United States Department of Agriculture Bulletin No. 556. In the use of this bulletin it is important that the engineer and architect read carefully the text, for, while the text appears simple, it contains explanations of many of the variations and the strength data which would otherwise be confusing. Bulletin No. 556 contains by far the largest collection and most authentic strength data yet published.

The committee offered the following comments in regard to working stresses in structural timber:

1. It is well determined that the strength of a particular piece of timber is in a measure determined by the condition under which it is used. Increase in moisture decreases the strength of timber, therefore it must be determined, first, in designing a particular structure, what the moisture conditions are.

2. It is also well determined by tests that resistance to suddenly applied loads is much greater than to slowly applied or constant loading; therefore the condition of loading will affect the amount of allowable stress.

3. Warning of failure of a piece of timber in a structure is usually given a considerable time in advance of actual failure; therefore, when efficient inspection is had this feature gives an element of safety in older structures.

While there is no well-defined "elastic limit" in timber tests, there is in general a region where the proportionality of stress to strain ceases to be constant. It is therefore well to keep stresses well within this limit. Timber, however, does recover from high stresses; therefore its resistance to quick loading.

From the above it will be seen that in order to have a rational design it is necessary to state working stresses of different amounts for different kinds of loadings and exposure of the timber. As an example, for dense structural yellow pine, the minimum working stress will be 1,100 lb. per sq. in. This is for constant loading and for submerged locations where the timber is constantly wet. In locations in the weather, such as bridges, the allowable working stress for constant loading is 1,400 lb. per sq. in. Under cover, where the timber is always dry, the allowable working stress for constant loading is 1,600 lb. per sq. in.

From the tests, it is determined that the resistance of timber is approximately proportional to the speed of loading. For constant loading, the stresses above given are proper, but for sudden loading, resulting in 100 per cent impact, the successive loadings being far enough apart so as to allow reasonable recovery of the timber, the allowable stresses may be doubled (not to exceed 2,800 lb. sq. in.), the stresses due to this sudden loading being those actually computed from the load with the impact. For other proportions of impact, less than 100 per cent, the allowable working stress may be increased in a ratio equal to the percentage of impact. For dense structural yellow pine, the allowable working stresses would, therefore, where I is the proportional impact stress, be as follows:

1. For wet or submerged locations.....$1100 + 1100I$ lb. per sq. in.
2. For exposed locations (bridges).....$1400 + 1400I$ lb. per sq. in.
3. For constantly dry locations.....$1600 + 1600I$ lb. per sq. in.

Other Papers

Duff A. Abrams presented a paper on "Wear Tests of Concrete," containing the following general conclusions:

In general the tests showed that the factors that give concrete of a high strength produce concrete of low wear. Increasing the quantity of cement decreases the wear. Increasing the quantity of mixing water causes a material increase in wear. The coarser the grading of the aggregate up to certain limits the lower the wear. One of the most significant results of the tests was to bring out the importance of curing concrete for a time in a moist condition. The quality of fine or coarse aggregate produced less effect on wear than is commonly supposed. The wear was materially reduced by increased mixing. The wear of concrete was not sensibly increased by the use of hydrated lime or other admixtures used in the tests up to 20 per cent of the volume of cement. Wear was reduced with the age of concrete.

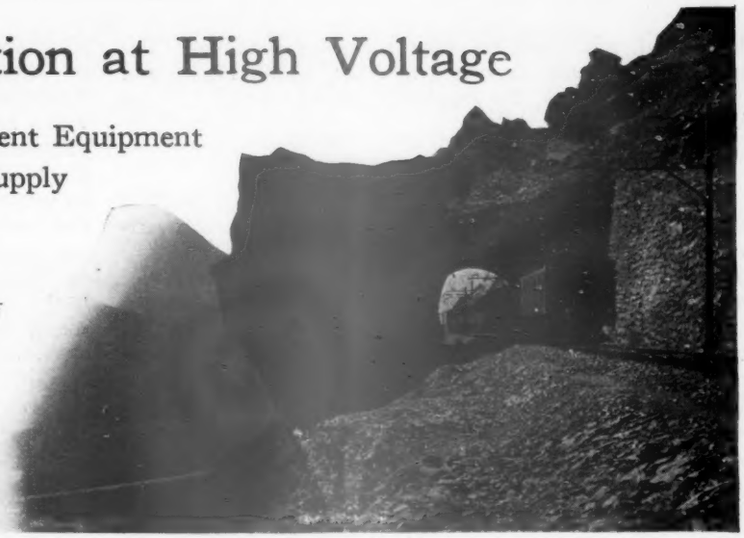
The committee on preservative coatings for structural steel submitted, among other tentative specifications, the results of its studies on South American flaxseed in the form of two proposed tentative specifications, one for the purity of raw linseed oil and the other for the purity of boiled linseed oil as made from South American seed.

Railroad Electrification at High Voltage

The Development of Alternating Current Equipment and Its Relation to Power Supply

By F. H. Shepard

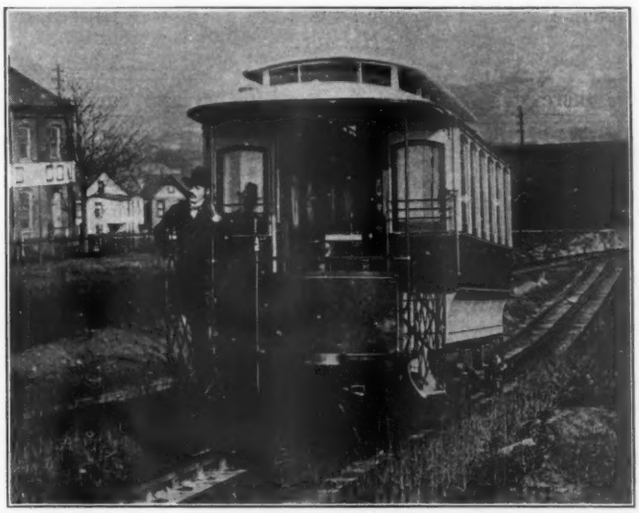
Director of Heavy Traction,
Westinghouse Electric & Manufacturing Company



Train on Loetschberg Railway, Switzerland, Hauled by 15,000 Volt, 2,500 hp. Locomotive

THE OVERHEAD TROLLEY is now accepted as the standard contact system for American railroad electrification, and, in fact, is the only contact system suitable for high voltage. The expansion of the use of electric power has been essentially due to the use of high, and still higher voltages. How, therefore, can we hope for electrification in its highest estate without recourse to high, and still higher voltage on the trolley?

The first use of electric power for full size railway trains was on the Baltimore & Ohio tunnel in 1895. The commitment for this had been made as early as 1891, when the Baltimore tunnel was under construction. This operation was heralded as "Railway Electrification," and the success of these locomotives led to popular references to



First Experimental Single-Phase Car, Pittsburgh, Pa., 1892

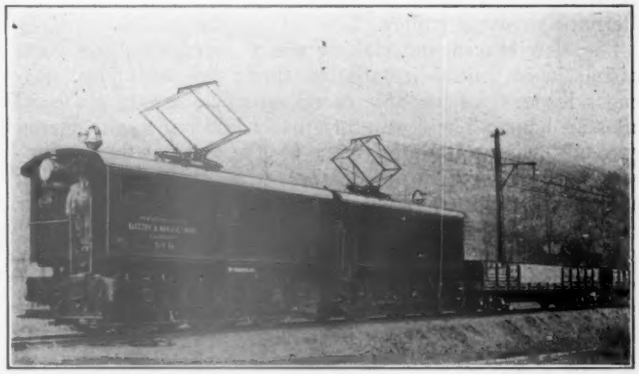
the "death knell of the steam locomotive." Subsequent history has shown how far afield these popular references were.

The various studies and consideration for extensive electrification always led to the economical necessity that the contact system be operated at some high voltage. A number of studies were made in which three-phase working conductors were considered. One of the most important of these was that for the Cumberland grade of the Baltimore & Ohio by Messrs. Duncan and Hutchinson, in 1896. The first extensive application of these three-phase was on the Valtellina Railroad in Italy in 1901.

Alternating Current Tried in 1892

As long ago as 1892, Benjamin G. Lamme had experimented with a commutator type motor, using alternating current at very low frequency. While this experiment was successful from the standpoint of motor design, the development of the alternating current system lay dormant for a number of years, owing to the great pressure of other development. Mr. Lamme, about 1900, in order to respond to the increasing demand for a high voltage trolley, resumed his consideration of this development, and, in 1901, a contract was taken for an interurban installation for the railway line which was projected between Washington and Baltimore. The first public announcement of this was made in Mr. Lamme's paper before the American Institute of Electrical Engineers in September, 1902, and was received with great enthusiasm throughout the technical world. The equipment was built, but never installed, owing to the financial difficulties which prevented the completion of the construction of the railroad. This equipment comprised four 100 h.p. motors at 16 2/3 cycles, with 1,100 volts on the trolley, the motor voltage of 220 being derived from a transformer carried on the car. This equipment was run on a test line at East Pittsburgh, and operated with entire success.

The endorsement this practical undertaking gave to the single-phase system led to immediate activity by other manufacturers throughout the world. This comprised that of the



First Experimental Single-Phase Locomotive for Heavy Haulage, East Pittsburgh, Pa., 1905

General Electric Company, with a repulsion type of motor, described in the paper of W. I. Slichter, before the A. I. E. E. in 1904; the Winter-Eichberg armature excited repulsion motor; the Siemens' series motor and the series motor of the Oerlikon Company, as well as numerous alternatives, such as the Finzi, Deri, Latour and others. The enthusiasm with which the alternating current motor was embraced has unfortunately proved to be a serious handicap to its actual development and use. This is due to the fact that many of the early applications were made with equipment of insufficient capacity, undeveloped design, or untried features of

that period, which had no place in regular operation. The voltage of the trolley increased to 3,300, 6,600, 11,000 and even to 16,000 volts; the frequency was 15, 16 2/3, 25 and 42 cycles.

Results of Early Application

Most of these installations were designed to accomplish service comparable to that performed on the interurban railways, and as it was possible to maintain schedules far in excess of the capacity of the motors by voltage control of the single-phase equipment, the motors were almost always outrageously overloaded. This has been the principal reason that the maintenance costs were excessive.

At this time, with direct current, the practical limit of voltage supply was that for the motor—then, 550 volts. To raise the supply voltage, alternating current was adopted as the only available means.

The handicap imposed by the combined operation over direct current lines ultimately led to the replacement of some of this equipment with direct current at 600 and 1,200 volts.

The legislation compelling the use of vaporless traction in the Fourth Avenue tunnel leading to the Grand Central Terminal at New York, compelled the adoption of electric service for that operation. While the New York Central adopted the third-rail system, the New York, New Haven & Hartford, which was under legislative restriction prohibiting the use of the third rail in the state of Connecticut, decided to use an alternating current system with 11,000 volts on the trolley as that which promised to be the most suitable for its requirements, with special reference to the needs for the future.

The Westinghouse Company had, in the meantime, through its study of the electric service for the St. Clair tunnel, developed a 120-ton locomotive, which had been operated experimentally at East Pittsburgh with satisfactory results. This experiment settled the questions of the effect of pulsating torque upon adhesion, commutation of large motors, and the various questions of control. The use of the overhead trolley on the New Haven led to a controversy, which oftentimes took the nature of the burlesque, regarding the relative virtues of direct-current third-rail versus the alternating-current trolley.

The New Haven undertaking was a courageous one, comprising in its initial installation thirty-five 1,000 hp. passenger locomotives, capable of operating at speeds up to 80 miles an hour. These were originally laid out as the geared type, but owing to the preference for the gearless the locomotives as constructed were of that type, with the resulting increase in weight entailed. The design of this locomotive was further involved, due to the undertaking to operate over the direct current third rail into the Grand Central terminal. This installation, in many respects, was truly a pioneer one, involving the determination of many features which had previously been untried. Among them were the following:

1. The generation of single-phase power in large steam turbo units.
2. The installation of high voltage trolley exposed to the continued exhaust from steam locomotives.
3. The installation of an overhead conducting system on a four-track railroad.
4. The development of a selective system of circuit breaker protection to handle short circuits of high capacity and great frequency compared to the commercial service then accomplished.
5. The first use of gearless single-phase motors.
6. The combined use of alternating current and direct current on locomotives.
7. The inauguration of a service without the trial period of elements included in power house, line and locomotive.
8. The extensive undertaking of electric service by a steam railroad organization.

The result of the New Haven installation was to establish the sufficiency of an overhead trolley at high voltage for railroad service. There was demonstrated as well, the flexibility of alternating current in railway service. This service developed, on a considerable scale, the various conditions which are necessary to satisfy the successful operation of an alternating-current system. In the case of the generating plant, it was shown that damper construction was necessary on generators and that circuit breakers of greater capacity and more rugged type were required. For the line, there was shown the type of installation necessary to withstand the exhaust of the steam locomotives, and also that the initial requirement for mechanical strength in the overhead conducting system was far less than anticipated, and, furthermore, that great attention should be given the question of flexibility at the traveling point of contact. On the locomotives there was developed the need for greater ruggedness in switches, auxiliary parts and connections, as well as certain changes in the mechanical parts of high-speed electric locomotives. The greatest handicap to the most successful operation and one which still prevails, is that due to overloading the equipment. This has apparently been difficult, if not impossible, to prevent, and prevails even to this day to an unfortunate extent. The education of the operating forces on steam railroads has, however, been progressing, and it will undoubtedly follow that railroad electrification in the future will recognize the inevitable fact that electrical apparatus of no kind or type can be overloaded without undue cost for maintenance.

Electric Passenger Train on the New York, New Haven & Hartford

Owing to the accepted advantage of a high voltage trolley, and due to the activities of Frank J. Sprague, complemented by those of James Bryan, the equipments for 1200-volt direct current operation for the Pittsburgh, Harmony & New Castle Railway were built in 1906 and placed in operation in 1907. These equipments were built by the General Electric Company of America. Previous to this time, there had already been placed in operation, in Europe, equipments at 850 and 1,000 volts direct current. The voltage of 1,500 volts was developed later by the Westinghouse Company for the Piedmont & Northern and the Southern Pacific Company. The overhead trolley at 2,400 volts was used on the Butte, Anaconda & Pacific with 80-ton locomotives, and in 1916, the Chicago, Milwaukee & St. Paul inaugurated its notable installation of 440 miles across the Rocky mountains at 3,000 volts direct current.

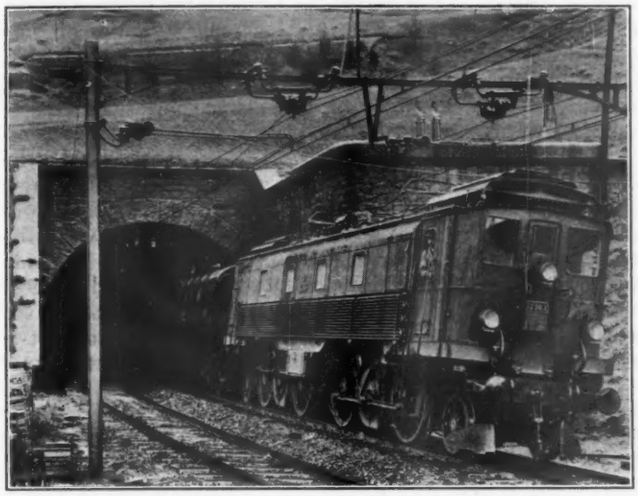
The Use of High Voltage Alternating Current for Traction in Europe

In Europe, following the initial development of 1904, there has been carried on a comprehensive analysis of high voltage railway electrification with the use of alternating current, and also with direct current. In Sweden, comparisons were made with direct current voltage as high as 4,000 volts on the trolley. Decision has followed in the case of Sweden, Norway, Germany, Austria and Switzerland to standardize upon

15,000 volts, single-phase, at 15 and 16 2/3 cycles, and there are now in operation approximately as follows:

In *Sweden,* 300 miles of track, with 125 miles under construction; in *Norway,* 60 miles, with 50 miles under construction; in *Germany,* 600 miles, with about 100 miles under construction; in *Austria,* 200 miles, and in *Switzerland,* 300 miles, with 300 miles under construction.

In *Italy,* following the successful operation of the Valtellina Railroad, there has been constructed about 600 miles using three-phase at 3,300 volts, and this has been settled as standard for all the heavy railroad operation in Italy, which includes practically the whole of northern Italy. For the lines of light traffic, consideration is being given in Italy to the use of 42 cycles and a higher voltage trolley, and also to a transmission system for both railroad and commercial use, with possibility of high voltage direct current on the trolley.



Passenger Train at South Portal of the St. Gothard Tunnel, Swiss Federal Railways, 1921. Locomotive Develops 2250 h.p. from a 15,000-Volt, Single-Phase Trolley

In *France,* subsequent to the decision of the Midi Railway to electrify with single-phase, there followed a controversy with the post and telegraph department of the government which has finally led to the decision to use 1,500 volts direct current with a third rail conductor as a standard for all the railways in France.

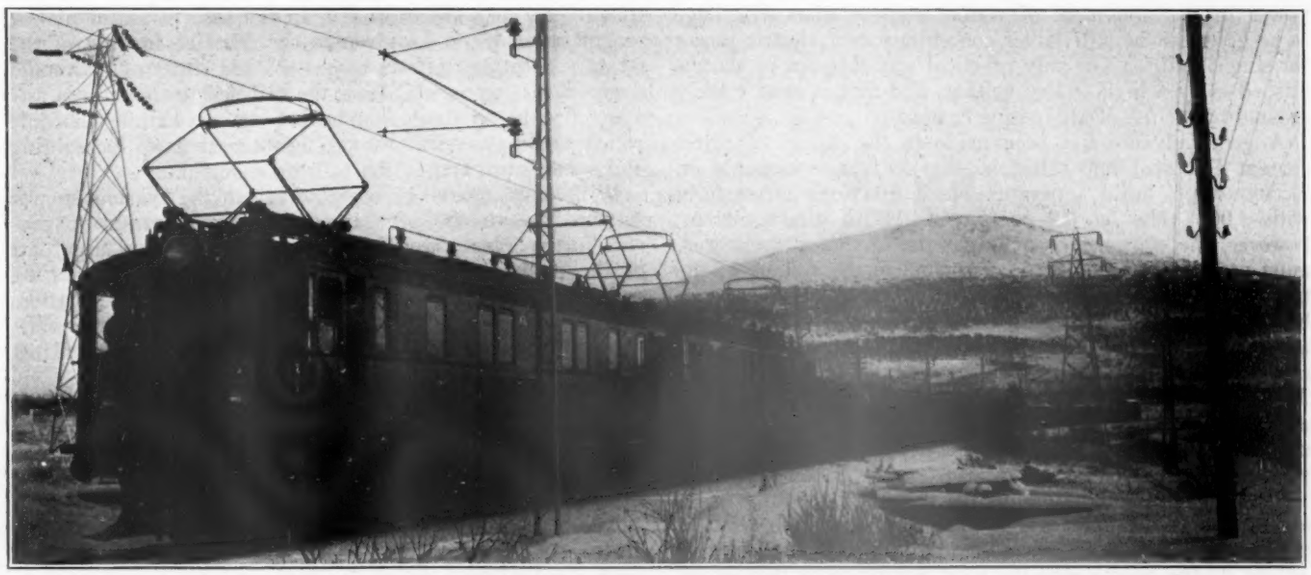
In *England,* 1,500 volts direct current with third rail has been adopted as the preferred type, the overhead construction being considered impracticable for general use on account of the limited overhead clearances, although in England the most extensive electrification, that of the London, Brighton & South Coast, will be continued with extensions of the single-phase trolley. In *Belgium* and *Holland,* the importance of multiple unit service with small distances and light trains has led to a decision to use 1,500 volts direct current; in Belgium, with third rail, and in Holland, with the overhead trolley.

Present Conditions in America

In America, the commission of the Pennsylvania Railroad, after nearly two years' investigation, decided to use the alternating current trolley at 11,000 volts and 25 cycles. There followed the electrification of the Philadelphia terminal at Broad Street, which includes suburban service as far as Chestnut Hill and Paoli. The Norfolk & Western decided to use the single-phase trolley, and, for extremely heavy service, has used the split-phase type of locomotives, the induction motors being fed from a single trolley through the medium of a phase converter.

It should be recognized that the most comprehensive electrification in America involving high speed passenger service, freight service, multiple unit service and switching service, is that of the New York, New Haven & Hartford, where some 500 miles of track are operating at 11,000 volts on the trolley. In this service there are more than 100 electric locomotives and a large number of multiple-unit cars used for the local passenger service as well as classification yards of great extent.

The heaviest service performed electrically is that on the Norfolk & Western, where coal traffic is moved with heavy tonnage trains over the Elkhorn grade section. The performance of each electric locomotive in this service is the practical equivalent of four of the large Mallet steam locomotives replaced. Current input as high as 15,000 kilowatts per train has been reached in this operation. The dispatch with which this service is handled is double that for the former steam service, and this installation forms a good illustration of the increased capacity which may be secured through electrification.



A 15,000-Volt, Single-Phase Locomotive in Service in Lapland, Sweden, 1920

On the Pennsylvania Railroad, at Philadelphia, with

multiple unit trains the flexibility of operation has very greatly reduced the congestion, which would otherwise have required a large addition to that terminal.

In general, an electric locomotive has been used to supplant a steam locomotive and, in this respect, has followed the general history of electrification of other industries. While this has been of benefit, the great value for electrification, and this applies especially to America, lies in the ability to accomplish, with electric power, service which would be entirely impossible with steam.

Future Needs

There is arising in America the imperative need of greater capacity for our transportation systems and greater dispatch in the movement of traffic. This latter, in fact, seems to be the logical way by which expansion of our railroad machine can take place. There is no good reason why an electric locomotive cannot remain at the head of a train for a run of hundreds of miles, or why electric locomotives cannot haul a train at speeds much in excess of those which are ordinarily attained with steam service.

There will develop, therefore, with the extension of electric power, the need for a large increase in motive power for each train unit. This may be taken to be roughly equivalent to four times the maximum horsepower now used for the propulsion of a train by steam. This will be utilized in hauling larger freight trains at higher speeds and will enable traffic movement to be handled on schedules which will be somewhat comparable to the movement of passenger trains. Thus, an electrically hauled freight train will be able to continue on the main line for the larger part of its course, thereby facilitating its arrival at terminal points on schedule, which alone will go a long way toward reducing the present serious congestion at terminal points. In fact, except for local distribution, the need for terminals should very largely disappear. A step in this direction was developed to clear up the congestion which existed on our railroads during the past year, trains, in many instances, being made up and run solid for great distances.

If this view is to be taken as to the utility of electric power in the movement of traffic, consideration will have to be given to the still larger concentration of electric power for single trains. The only practical way this can be accomplished is by a high trolley voltage, and this is most readily secured by the use of alternating current.

A great advance has been made in the design of direct current electrical apparatus, so that it is now possible on locomotives to build apparatus which functions successfully with 3,000 volts on the equipment. With direct current, however, the equipment, including the auxiliary apparatus, must necessarily be built to correspond to the voltage of the trolley, while with alternating current the equipment can be designed for the most economical and conservative voltage, and, through a static transformer, receive power from an alternating current trolley at a comparatively high voltage. This is shown by the use of motors of 300 to 400 volts from a 15,000-volt trolley. In fact, as far as the equipment is concerned, its design is quite independent of the trolley voltage.

Inasmuch as some time in the future it is universally accepted that the operation of our railroads with electric power will be great in extent, the development necessary to utilize electric power with the least restriction is that which should be given the utmost consideration. It should not be taken as fanciful to consider a district with complete electrification of the main lines of 500 to 1,000 miles handling the heaviest kind of traffic. The large trains, and the occasional bunching of trains, which is inevitable on certain sections of this major electrification, will cause a relatively poor load factor.

Since this is a condition which should be recognized, it is obvious that the best use of the investment for transmission and transforming apparatus local to any given section of railway will be that which utilizes the highest voltage for the supply of power to the trains. In other words, to meet the concentration of loads which will be necessary in the future the tendency is toward the highest practicable voltage on the trolley as a matter of economy.

Methods for Meeting Demands of the Future

There follows logically the suggestion that even with the highest voltage on the trolley the demand for railroad power should be equalized by the inclusion of many miles of railway deriving their power supply from a common feeder. This, in turn, could very well be at the highest practical voltage, so that it might be considered that hundreds of miles of railway would be fed from a super railway feeder.

The traffic movement on our railways varies during the day, from day to day, and from season to season. It is also subject to fluctuations due to conditions of weather and derangements in train service due to obstructions on the track, wrecks, and other causes. Allowance must be made for a considerable flexibility of movement to avoid congestion. Unfortunately, this condition does not produce an ideal demand from a power generating system, so that a railroad load is not generally considered to be a desirable one.

Close regulation of voltage for railway use is of less importance than that for industrial use, especially where a lighting load is carried, so that an independent railway feeder should be more economical than supply from a common feeder system with its requisite regulation with a superimposed railway load.

For such a scheme of power supply to our railways, it should follow that power could be taken from the various regional generating systems for common supply according to a schedule or set condition, which could be adapted to use power in the most effective manner. For instance, during times of lesser demand for commercial power, such as nights, Sundays and holidays, there should be little, if any, restriction of power supply from any of the power systems. In the case of hydro plants, the demand should recognize the characteristics of each system, whether dependent upon stream flow or water storage. In the case of steam plants, consideration could be given to the effective loading of the steam generating units in operation. At times of maximum demand for commercial load, the railroad demand from any system could be limited according to a definite schedule which would avoid super-imposing the peak loads for lighting and urban transit upon the railroad demand.

With such flexibility of relation to the various power systems, the amount of spare generating apparatus to provide for emergency would be lessened. In fact, a large part of the railroad load could, undoubtedly, be furnished by assigned generating units, and through their regulation, transfer of load would be readily secured over the super railway feeder, independent of the commercial demand and net work.

For such minor transfer of power between the railroad system and the commercial network as might be advantageous, motor generators could be used, thus lessening the burden of cost due to a frequency for railroad use which may differ from that of the commercial net work.

The expansion in electrical generating capacity for industrial and commercial use has been phenomenal in America. Undoubtedly, this growth is destined to continue to very large proportions. The generation of electric power for railroad use may also be expected to develop and grow. Each, therefore, should be able to develop without restriction by the other, and each in the utilization of nature's resources, could very properly be used to complement the other. It would appear, therefore, that we have not yet reached the time when railroad electrification should be dominated by conditions of power supply and distribution for other purposes.

Railroad Hearings Before Senate Committee

Railroad Testimony Completed by L. E. Wettling and W. H. Williams—S. Davies Warfield Presents Plan

WASHINGTON, D. C.

THE PRESENTATION of direct testimony on behalf of the railroads before the Senate Committee on Interstate Commerce was concluded on June 17 and an adjournment was taken until June 22, when S. Davies Warfield, president of the National Association of Owners of Railroad Securities, appeared. Chairman Cummins was the only member of the committee to hear the final testimony of the railroads presented by L. E. Wettling, manager of the statistical bureau of the Western lines, and W. H. Williams, chairman of the Wabash.

The railroads in 1920 suffered a deficit of two-tenths of a cent for each mile run by a train, Mr. Wettling showed in continuing his testimony on June 16. The average revenue received by the carriers per train mile was $5.065, while the average expenses and taxes per tain mile were $5.067. For the last four months of the year, when the increased rates were in effect, the average revenue per train mile was $5.883 and the expenses and taxes $5.328, leaving a net railway operating income per train mile of 55.5 cents.

In 1916 the average revenue per train mile was $2.938 and the average expenses and taxes were $2.089, leaving a net operating income of 84.9 cents. While the increase in revenue per train mile from 1916 to the latter part of 1920 was $2.945, the increase in expenses and taxes was $3.238 and the net operating income was reduced by 29.4 cents.

Total operating expenses were also divided in the exhibit between labor and materials and supplies. Whereas in 1916 the labor cost per train mile was $1.20, in the last four months of 1920 it was $3.27. While materials and supplies per train mile in 1916 cost 72.6 cents, in the last four months of 1920 they cost $1.75. The average revenue per mile for freight trains in the last four months of 1920 was $7.94 and the average revenue for passenger train was $2.465.

Mr. Wettling said railroad operating revenues in 1920 were by far the largest in the history of the railroads, although the net operating income left after paying expenses and taxes was the smallest on record for a year. Of every dollar taken in by the railroads in 1920, 59.9 cents was expended for labor, as compared with 55.3 cents in 1919; 10.9 cents went for fuel for locomotives as against 9.2 cents in 1919; 17.3 cents for material, supplies and miscellaneous as against 15.6 cents in 1919, and 10.9 cents for loss and damage, injuries to persons, insurance, depreciation and retirements, and taxes. These items in 1919 took 11.1 cents of each dollar. Only 1 cent was left in 1920 for return on investment, as against 8.8 cents in 1919 and 28.9 cents in 1916.

An analysis of the expenditures follows:

	1916	1919	1920
Total operating revenues....	$3,596,865,766	$5,144,795,154	$6,171,493,301
Amount			
Labor	1,468,576,394	2,843,128,432	3,698,216,351
Fuel (locomotive).....	250,544,862	474,174,792	672,891,964
Loss and damage.....	30,958,221	116,683,270	122,022,696
Injuries to persons.....	29,485,700	37,314,145	50,682,684
Insurance	10,731,935	410,677	15,884,079
Depreciation and retirements.	119,785,157	126,292,105	145,252,339
Material, supplies and miscellaneous	447,316,143	801,712,094	1,063,769,900
Uncollectible railway revenues	797,486	916,889	1,224,980
Taxes	157,113,372	232,601,396	278,868,668
Hire of equipment and joint facility rents.....	41,471,979	56,576,401	60,751,014
Return on investment.....	1,040,084,517	454,984,953	61,928,626

Despite the fact that the railroads handled more business in 1920 than ever before in their history, the average number of train miles operated per 100 hours of work by the train service employees was 8 per cent less than in 1916, Mr. Wettling showed. At the same time, the labor cost for operating a train one mile, he said, increased from $1.20 in 1916 to $3.27 in the last quarter of 1920, or an increase of 264 per cent.

Mr. Wettling filed with the committee statistics which showed that while the number of hours worked by 10 classes of road trainmen increased from 626,800,000 in 1916 to 670,800,000 in 1920, or seven per cent, the mileage of the trains run in transportation service decreased in that period from 1,224,000,000 to 1,205,500,000, or 1.52 per cent, because of the heavier load carried per car and per train.

While the railroads were obtaining a constantly increasing efficiency in the movement of each car of freight and each locomotive, Mr. Wettling said, the efficiency of the individual employee declined.

Mr. Wettling told the committee that the wage bill of the carriers in 1920, which totaled $3,698,000,000, exceeded by more than $100,000,000 the gross revenues of the railroads in 1916, which was the best year in railroad history prior to the war. In 1916, he said, their gross revenues were $3,596,865,000.

The average compensation of railroad employees per hour increased from 27.8 cents in 1916 to 66.5 cents in 1920 and 70.4 cents in the last quarter of 1920, Mr. Wettling said, while the average compensation per employee per day increased from $3.048 in 1916 to $6.156 in 1920 and $6.513 in the last quarter of 1920. The average annual pay increased, he said, from $892 in 1916 to $1,904 during the last four months in 1920, while if the wage award of the Railroad Labor Board had been in effect throughout the year of 1920 instead of from May 1, the average for the year would have been $1,926.

Despite the fact that the railroads in 1920 employed 289,841 section men, or an increase of 36,264 or 14 per cent more than were employed in 1916, they actually worked during the past year 761,965,074 hours or 23,507,094 hours less than was worked by the lesser number of section men in 1916. Their average pay, however, in 1920, was $1,192, as compared with $509 in 1916, or an increase of 134 per cent. Had the wage award of the Labor Board been in effect throughout 1920 their average annual pay, he said, would have been $1,252.

Mr. Wettling said that in 1916 the total compensation of section men was $129,033,692, while in 1920 it was $345,511,579.

Statistics filed by the carriers with the Interstate Commerce Commission, the witness added, showed that despite an increase of 18 per cent in the number of other unskilled laborers employed by the railroads compared with 1916 and an increase during that period of 115 per cent in compensation those employees worked 311,282,925 hours in 1920, or a decrease of 11,230,000 hours. Their average annual pay last year, he said, was $1,311, compared with $609 in 1916.

The largest increase in rates of pay received by any class of employees under the wage award of last July, Mr. Wettling said, was that of the car inspectors, who were increased 231 per cent over 1916.

General officers receiving $3,000 and upwards per annum from 1916 to 1920 actually suffered a reduction of about 10 per cent in their pay.

Mr. Wettling told the committee that up to February last the relative increase in freight rates in the past eight years

had been less than the increase in wholesale commodity prices. In 1913 average receipts per ton-mile was 7.19 mills while in 1916 it had decreased to 7.07 mills. In 1917 it was 7.15 mills and in November, 1920, three months after the increase in rates became effective, it was 12.63 mills, or an increase of 77 per cent over the average receipts in 1913. For the same month the increase in wholesale prices was 107 per cent over 1913. He said that the increase in freight rates and the decline in wholesale commodity prices passed each other last February and that in March the average receipts per ton-mile was 13.33 mills, or an increase of 85 per cent over 1913, while for the same month wholesale prices showed only 62 per cent increase over the same year.

Increased Revenues Absorbed by Advances in Wages and Other Expenses

How increases in railway earnings resulting both from increased traffic and from increases in rates have been more than absorbed by increases in operating expenses, chiefly by increased payroll costs, which in 1920 practically wiped out the net operating income, was strikingly illustrated by statements filed by Mr. Wettling. From 1912 to 1920 the increase in total operating revenues was $3,366,000,000, or 120 per cent, while the increase in operating expenses was $3,809,000,000, or 194 per cent, and the increase in compensation of employees was $2,489,000,000, or 205 per cent. The payroll was 43.13 per cent of the revenues in 1912 and 59.92 per cent in 1920. The average compensation per employee during this period increased from $736.68 to $1,820.05, or 147 per cent, and during the latter part of 1920 the average wage was at the rate of $1,904 per year.

From 1916 to 1920 the revenues increased $2,575,000,000, or 70 per cent, but operating expenses increased $3,411,000,000, or 145 per cent, and the payroll increased $2,230,000,000, or 152 per cent. In 1916 the payroll was 40.83 per cent of the revenues and 62.3 per cent of the expenses.

From 1916 to 1917 the revenues increased $418,000,000, or 11 per cent, resulting in part from increased traffic and in part from an increase in rates, but the expenses increased $472,000,000, or 20 per cent, and the payroll increased $271,000,000, or 18.6 per cent, largely as the result of the passage of the Adamson law in 1916.

In 1918, after the government took over the railroads, wages were increased effective as of January 1, and rates were also increased effective during the last half of the year. There was also an increase in traffic as compared with 1917. The revenues increased $866,000,000, or 21 per cent, the operating expenses increased $1,153,000,000, or 40 per cent, and the payroll increased $877,000,000, or 50 per cent, amounting to 53.55 per cent of the earnings and 65.64 per cent of the expenses.

From 1918 to 1919 there was a decrease in traffic and no general rate advances were made but the increases made in 1918 were in effect throughout the year and some additional wage advances were made. The revenues increased $264,000,000, or only 5 per cent, but the expenses increased $417,000,000, or 10 per cent. The payroll increased $230,000,000, or 8 per cent.

In 1920 there was a new wage advance effective from May 1, but the rate advance did not become effective until August 26. From 1919 to 1920 there was an increase in revenues of $1,027,000,000, or 20 per cent, due to increased traffic and in part to the rate advance in effect for four months, while the expenses increased $1,369,000,000, or 31 per cent, and the payroll increased $855,000,000, or 30 per cent.

From 1917 to 1920, comparing the years before and after the period of federal control, the increase in revenues was $2,157,000,000, or 53 per cent. The increase in expenses, however, was $2,839,000,000, or 100 per cent, or $682,000,000 more than the increase in earnings. The increase in the payroll was $1,959,000,000, or 113 per cent. In 1917 the payroll was 43.33 per cent of the earnings and 61.43 per cent of the expenses. In 1920 it was 59.92 per cent of the earnings and 64.11 per cent of the expenses. The net operating income fell from $934,000,000 in 1917 to $62,000,000 in 1920. Besides the increase in expenses there was an increase of $65,000,000 in taxes and there were also some increases in equipment and joint facility rentals.

Increase in Expenses Greater Than Rate Increase

That the poor showing made by railway net operating income since the increases in rates were made effective on August 26 was due more to increases in expenses than to the reduction in traffic was illustrated by a table comparing the results for the six months ended with February, 1921, with those for the corresponding period of the previous year.

The railway revenues for this period showed an increase of 16 per cent, or from $2,825,000,000 to $3,277,000,000, but operating expenses increased 17.9 per cent, or from $2,443,000,000 to $2,880,000,000 and taxes increased from $115,000,000 to $144,000,000, or 25.8 per cent. During this period both the increased rates and the increased wage rates were in effect. The net railway operating income was $218,120,632, a decrease of 6 per cent as compared with the corresponding period of the previous year. This was at the rate of 2½ per cent per annum on the railroad valuation.

In spite of a decrease in both freight and passenger traffic for the six months as a whole, the freight revenues for the period increased 21.6 per cent, as compared with the corresponding six months of the previous year, while the passenger revenues increased 14.4 per cent.

Railroad Traffic Performance in 1920 Set New Record

The railroads in 1920 performed 12.6 per cent more freight service and 1.2 per cent more passenger service than in 1919, exceeding all previous records for a year, according to exhibits filed by Mr. Wettling. The freight service is measured by the number of tons of revenue freight transported for a distance of one mile, a total of 409,970,656,000 ton-miles, which was an increase of 45,000,000,000 ton-miles, as compared with 1919. The number of tons carried was 2,234,547,672, an increase of 9.9 per cent, and the average distance each ton was handled per railroad increased from 178.97 to 183.47, or 2.5 per cent.

The number of passengers carried was 1,234,222,889, an increase of 5.1 per cent, but there was a decrease in the average journey per railroad from 39.32 miles to 37.86, or 3.7 per cent. As a result the passenger miles increased only 1.2 per cent.

Including non-revenue freight the railroads handled 449,292,355,000 ton-miles, an increase of 13.2 per cent over 1919 and a new record for a year. By increased efficiency in car loading and by increasing the average trainload this increase of 13.2 per cent was handled with an increase of only 11.3 per cent in train mileage. The average revenue received by the railroads for hauling a ton of freight one mile was 1 and 5/100 cents and the average revenue per passenger mile was 2 and 74/100 cents.

Maintenance Restricted by Railroad Administration

The director general, through orders restricting the amount to be spent for maintenance during the period of federal control, thereby resulting in the railroads being turned back on March 1, 1920, in a condition of undermaintenance, was largely to blame for the increased expenditures made for that purpose during the past year compared with 1919, Mr. Williams testified.

"A substantial portion," said Mr. Williams, "if not all, of the increase in number of units of material and number of hours of service performed in the year 1920 as compared

with the year 1919 over and above that necessitated by increased service was due to the under-maintenance of 1919 and not to any over-maintenance in the year 1920. Orders issued by the director general limiting the expenditures for maintenance during the year 1919 were largely responsible for this situation. The machinists' strike in August, 1919, was partly responsible for the under-maintenance of locomotives and cars in that year. During the latter part of the year, the director general declined to authorize any new addition and betterment work unless the carriers agreed to finance the same, which most of them were unable to do owing to uncertainty as to their future.

"Order No. 20, issued by the Director, Division of Operation, limited the expenditures for repairs or additions and betterments to certain types of cars, with the result that a substantial number of cars was allowed to get in such condition as to necessitate very heavy expenditures and required their being set off on side tracks; and no charge was made during the year 1919 to cover the cost of placing these cars in proper condition."

Mr. Williams cited a long list of additional orders issued by the director general in 1919 and shortly before the roads were turned back in 1920, the "wording of which orders seemed to indicate that their purpose was to limit expenditures during the period of federal control to the amount which the government was obligated to expend for maintenance of the properties."

"Their practical effect, however, owing to the improper basis established, was to cause serious under-maintenance," Mr. Williams said. "All the under-maintenance of the period of federal control was not made up during the year 1920, owing to the inability of the railroads to secure sufficient rails and ties.

"The director general's telegram of May 27, 1919," he said, "instructed that the ratio of maintenance of way expenditures to operating revenues in June should be no greater than the average maintenance of way ratio for the entire 36 months of the test period. When issuing this order, the director general overlooked the fact that maintenance expenditures in the summer months are necessarily much greater than in the winter months inasmuch as it is not advisable to disturb track during cold weather. He also overlooked the fact that revenues had not increased proportionately with the increase in operating costs and that increases granted to maintenance of way and shop labor were greater than the average increases of all classes of employees. In determining the basis of settlement with the director general for upkeep of the property for the last two months of federal control, viz., January and February, 1920, the director general agreed with the railroads that it was not advisable to expend in each of said months only one-twelfth of the annual maintenance charged during the test period and agreed to accept for said months one-sixth of the annual charge, notwithstanding the fact that a less amount was actually expended, thus conceding that a mistake had been made in issuing the order of May 27, 1919, limiting the expenditures during the summer months of that year."

During the past 10 years, Mr. Williams said, the Wabash had made a practice of renewing rail in its high speed main tracks about once in every 12 years. During the federal control period only 83 track miles of new rails were laid, or 107 miles less than the standard previously maintained by that road.

In order to make the Wabash track safe for operation in 1920, it was necessary for the Wabash to make up this deficit of 107 miles which accrued during federal control and to lay an additional amount of 44 miles partially to take care of the current year, the witness said.

During federal control, he said, 1,052,043 ties should have been placed in order to maintain previous standards. Instead, however, only 861,794 were actually furnished, which left a deficit of 412,880 ties during the period of federal control.

"In general," Mr. Williams continued, "repair costs for all classes of equipment were much higher in 1920 than in 1919, due to the fact that the 1919 year was a subnormal year of maintenance and during 1920 an effort was being made to re-establish normal conditions. One reason for the subnormal maintenance during 1919 was the reduction in shop forces brought about by regional director's instructions that maintenance of equipment expenses must not exceed a certain percentage of gross earnings."

Mr. Williams denied that existing freight rates are responsible for present business conditions. The rates, he said, have had no appreciable effect on the volume of business carried by the railroads and only a slight effect on the costs of commodities, virtually all of which, because of general market conditions, have been greatly reduced in price during the past year.

Mr. Williams attributed present business conditions to the readjustment that is now in progress throughout the world in an effort to return as nearly as possible to the pre-war conditions and the fact that the country is "now suffering from the unusually large inventories" which resulted from "an artificial augmentation of business" in 1920, "the cause of which was not thoroughly understood."

"No material increase in the volume of traffic can be expected until the inventories are reduced to normal," Mr. Williams said.

Because of over-production in 1920, he estimated that bituminous coal production this year would be from 100,000,000 to 125,000,000 tons below last year. A similar situation, he said, has developed as to sugar, as well as in many other industries with the result that falling prices have resulted in severe losses.

"The sugar companies of Canada lost in 1920 an amount equal to the profits of the preceding six years, this being due to the rapid fall in prices," Mr. Williams said.

Present Conditions in U. S.

Speaking of conditions in this country, he said:

"Furnace coke has dropped from $17 per net ton, in October, 1920, to $3.50 per net ton, in 1921.

"Open-hearth steel billets at Pittsburgh dropped from $65 per gross ton, in July, 1920, to $37 per gross ton, in April, 1921.

"Pennsylvania crude petroleum dropped from $6.10 per barrel, in October, 1920, to $3 per barrel, in April, 1921.

"No. 1 Northern spring wheat, at Chicago, dropped from $2.22½ per bushel, in October, 1920, to $1.33¾ per bushel, in April, 1921.

"Ohio fine delaine wool, clean basis, Boston, dropped from $2.35 per pound, in April, 1920, to $0.92, in April, 1921.

"Prime Western zinc, St. Louis delivery, dropped from $7.30 per hundred, in October, 1920, to $4.60, in April, 1921.

"Middling, spot cotton, New Orleans delivery, dropped from 20.25 cents per pound, in October, 1920, to 11.25 cents per pound, in April, 1921.

"No. 2 mixed corn, Chicago delivery, dropped from 95 cents per bushel, in October, 1920, to 55½ cents per bushel, in April, 1921.

"Fair to choice native steers, Chicago delivery, dropped from $14.75 per hundred, in October, 1920, to $8.15 per hundred, in April, 1921.

"Pig lead, New York delivery, dropped from 7.80 cents per pound, in October, 1920, to 4.50 cents per pound, in April, 1921.

"Red (facing) brick are now selling at $12 per thousand, and salmon (backing-up) brick at $10 per thousand in St. Louis, being one-half of the peak prices of last year.

"These unusual drops in prices and consequent losses in inventories, have seriously affected the buying power of the

dealers and also have affected their ability to borrow funds. At the time the break in prices occurred, producers and wholesalers had on their books many unfilled orders which were subsequently filled at the high prices, with the result that retailers found themselves overstocked with goods at high prices."

Mr. Williams told the committee that the increase in freight rates had been so small that they cannot be said to account for any appreciable amount of the charges in livestock and grain prices. The wholesale price in Chicago of cattle in 1920 was $14.50 per hundred pounds and so far this year approximately $8.60, Mr. Williams said, while to ship cattle from Sioux City, Iowa, it costs only 44 cents per hundred pounds. The wholesale price of hogs, he said, was around $14.85 in 1920 and $9.25 this year while the freight rate from Des Moines, Iowa, to Chicago is only 40 cents a hundred.

Last year, according to the witness, the wholesale price of corn in Chicago was $1.41 per bushel and 64 cents this year while to ship a bushel from Decatur, Ill., to that city costs only 7⅘ cents. To ship a bushel of wheat from St. Cloud, Minn., to Chicago, Mr. Williams said, the cost is 15⅗ cents per bushel while in 1920 the wholesale price in Chicago was $2.80 and this year $1.47.

Although contentions have been made that existing freight rates have curtailed building operations, Mr. Williams said statistics from six industrial centers in Indiana, Ohio and Pennsylvania as well as the District of Columbia show that approximately twice as many garages as dwellings were built in 1920.

"This plainly indicates that materials for buildings that are very greatly desired must be moving in considerable volume," Mr. Williams said.

Some Suggestions for Relief

Mr. Williams submitted the following suggestions as a possible means of providing some relief for the railroads:

State commissions have required the re-establishment of unremunerative passenger service, erection of new passenger stations, and other expenditures which ought to be deferred. The Interstate Commerce Commission, which has authority to regulate the receipts of the carriers, should be the sole agency authorized to require additional service or expenditures for plant facilities.

Freight rates for car-lot shipments should be based upon the cars being loaded to their weight capacity or cubical content capacity. This would make it unnecessary to buy freight cars other than for replacements during the next five years; it would minimize the possibility of car shortage, and would materially add to the revenue tons per train and thereby lessen the cost of operation.

Governmental work, particularly road work, should be done at such times and by such methods as to interfere as little as possible with private enterprise. Materials for such work ought not to be moved by rail when open top cars are needed for the coal trade.

The existing rules with relation to seniority rights when men are promoted, or forces are curtailed, should be modified so as not to apply when those by whom they are claimed are seriously inferior in qualifications. "During the past three years," the witness explained, "the railroads have found it necessary to employ men not the most competent or qualified to perform the work for which they were taken into the service. Many of these men are not capable of assuming increased responsibility and should not be retained in their present positions."

Mr. Warfield's Plan

S. Davies Warfield, testifying before the committee on Wednesday, declared that only through far-reaching economical methods for conducting transportation and the obliteration of old-time prejudices can rates and fares be made satisfactory to the people and the railroads be enabled to compete with other forms of transportation and produce the return essential to enable the roads to finance their obligations.

He stated that a return on railroad property in the aggregate less than that provided for in the Esch-Cummins act would not maintain transportation, and any attempt to impair the provisions of that act would be a menace to the successful operation, in the public interest, of the transportation system.

"The question for the moment is," said Mr. Warfield, "Can sufficient revenue be obtained from rates and fares that will be considered reasonable by the public and the shippers, and will these rates bear a relation to the price obtainable for the articles transported that will not impede commerce; or will part of the money required to meet the necessities of transportation have to be supplied, in the public interest, by taxation?" The latter, he said, means government operation and eventual government ownership, and unless effective railroad organization is consummated to introduce rigid economies this could not be avoided.

Discussing freight rates he showed that the war produced abnormally high prices and high rail operating costs. When deflation set in prices broke precipitately and the unprecedented and unforeseen era of business readjustment, he said, was the real cause of the loss of business to the railroads.

"The exhaustion of general credit was manifest before the increase in railroad rates," said Mr. Warfield. "There had been a progressive decline in the reserve ratio of the Federal Reserve banks from the peak of August, 1917, caused by the expansion of bank credits of over 80 per cent to below 40 per cent in the early part of 1920; the increase in railroad rates was not made until August, 1920, when the exhaustion of credit showed its effect on commodity prices. The increase in rates cannot be held accountable for the contraction in business from which the railroads have suffered acutely."

The economies to be instituted, he classed under two headings: "one, by effecting an organization of the officials of the railroads as grouped in each of the four territories now established by the Interstate Commerce Commission; and two, through a central agency or corporation to supply equipment to the railroads without profit to the corporation, and to perform other services, under the supervision of the commission."

The commission has laid out the country in four districts, applying different ratios of increase or decrease in rates in the several districts, he said. On the aggregate group value of the property of the carriers in the respective groups the yield from rates is computed. He contended these and other conditions made it logical for the carriers of each group to organize themselves, a group railway board, of not less than five members, to be selected by each group of carriers. From among the carriers of the groups, men would be selected to report on advanced methods for producing economies. Three officials would be selected from the four group boards, 12 in all, to serve on a national board, with 12 additional members selected from the trustees of the National Railway Service Corporation. This national board would be composed of practical railroad officials and men trained in finance and general business administration. This board would determine questions of legislation and public policy.

"The group boards and their committees should be advisory," he said. "Neither the national board nor the four group boards would interfere with the boards of directors of railroads." The suggestions of the group and service boards now proposed should be submitted to the directors of the respective railroads, thus keeping before directors the relation of co-ordination to economical operation.

Through the organization proposed, information, he stated, would be available, scientifically assembled, to inform the shippers and the public of the relation of railroad rates to commerce. He contended that there is no organization of the railroads to speak with authority on these subjects, whose con-

clusions or suggestions could be accepted as authentic. "If the railroads themselves cannot produce convincing evidence of the necessity of a railroad rate and the relation that rate bears to the commodity transported fault cannot be found if governmental agencies step in to take up those questions," he said.

Mr. Warfield discussed the relation of valuation to the proposed consolidations and said that the group organizations, in co-operation with the recently appointed Board of Economics and Engineering, would be "helpful to the commission in working out the proposed large consolidations." He called attention to the desirability of keeping consolidations within reasonable limits so as not to impair incentive and retard the building into territories awaiting development. He advocated the immediate adoption of means to fund the obligations of the railroads to the Railroad Administration.

The purposes of the National Railway Service Corporation, organized by the association of security owners in July last, were outlined. This corporation, it was stated, has been supplying equipment to railroads otherwise unable to secure funds to purchase equipment. This corporation should not only supply carriers with equipment under long-time yearly payments, but, if so provided by Congress, it would be enabled to acquire a "floating supply" of equipment to be leased to carriers on a per diem basis. The railroads could largely reduce their capitalization for equipment, making purchases to meet only their normal requirements, securing from the service corporation the equipment to meet seasonal demands. Large savings would be made in first cost of equipment, and a greatly reduced number of cars required, the floating equipment being shifted from one railroad to another and from one section of the country to another.

He asked that Congress require a court or a receiver in a receivership to continue agreements made by carriers in the purchase of equipment. The knowledge that a receivership would not break an agreement would provide a more extended and stable market for the corporation's certificates.

He advocated the use of the excess earnings fund provided under the act through the corporation, to be used as a margin to enable the corporation to sell its equipment obligations at minimum rates of interest.

It was pointed out that the Esch-Cummins act and the commerce act give wide powers of supervision and regulation to the commission and the labor board. The commission is required to institute economies if the railroads themselves do not produce them. The railroad complaints of excessive regulation, he said, grew out of the lack of method for the co-ordination of effort. "It remains with the railroads themselves," he said, "to limit governmental regulation by the organization of agencies among themselves which would guarantee to the public and the shippers adequate transportation facilities at rates which the public must be satisfied are in line with intensive economies and wise administration."

He said the carriers had applied immediately to the Labor Board at Chicago before employing the methods contained in the Esch-Cummins act for the settlement of working conditions and wages. He quoted from the provisions of the act, giving specific methods for handling the questions, among others the formation of local or regional adjustment labor boards by the roads, the National Labor Board to be the board of appeal to settle disputed questions. Yet, he said, complaint is constantly made that the roads are now nearly operated by governmental agencies while little has been done to supply the machinery of organization to avoid or prevent it.

The reports of the commission of railroad revenue and expenditures, he said, gave conclusive evidence of the necessity for a reduction in wages. This is not the only remedy necessary in the emergency. Wage reduction, he stated, cannot entirely supply the means through which to meet the constant demands of the shippers for decreased rates, which can be secured through economies possible of attainment.

Mr. Warfield advocated co-ordinated relations between the commission and the labor board. He said while Congress had placed extensive powers with the commission, which provides the money through rates and fares to operate the railroads, the labor board, another governmental body, had been given the adjustment of wages, now constituting 65 per cent of all railroad operating expenditures. "Can the commission," he asked, "exercise 'authority to inquire into the management of the business—keep itself informed as to the manner and method in which the same is conducted—have complete information necessary to enable the commission to perform the duties and objects for which it was created,' when Congress, without co-ordinate relations between the two bodies, charges one with the sole right to fix wages, and the other with the duty of supplying the money from rates to pay them, keep the railroads running and enable them to sell their securities?"

Mr. Warfield discussed the Board of Economics and Engineering, appointed by the Association as "the only instrumentality free from entangling alliances, which could review the questions involved unhampered by ties of individual, railroad or financial identity or ownership, or by the influences of any particular security owning or banking group, and from the environment that attends governmental appointment." He gave the subjects now under investigation by this board, as follows: Standardization of equipment; repairs and shop practices; power economies, including locomotive improvements and electrification; car service; joint facilities and terminals; consolidations of railroads—valuation; transportation economies—loss and damage; routing of traffic; purchase of fuel and supplies; simplification of accounting; traffic rates and divisions; wages and working conditions. The board is in consultation with representatives of car manufacturing companies for the purpose of discussing standard methods in respect to equipment.

He stated that the group organizations and the plans proposed to investigate, report and institute economies under the group plan, had been gone into by the Board of Economics and Engineering, and it was the opinion of that board that through such organization large economies could be instituted.

Mr. Warfield presented drafts of two bills, one entitled, "An act to further economies and efficiency in railroad transportation," to effect the organizations suggested of the railroads in the four group territories; the other, "An act to incorporate the National Railway Service Corporation."

He said that Congress was not asked to enforce the suggestions made in relation to the economies to be secured, but request is made that the railroads themselves effect the organizations to secure these economies and to bring such relations between the carriers as will permit the economical operation of the transportation system as a whole. All of the actions of these boards are proposed to be subject to the supervision of the Interstate Commerce Commission.

In closing, Mr. Warfield stated: "It has been made apparent that the country cannot look to a thousand or so executives of railroads, nearly two hundred alone representing the great systems, to reach agreements and conclusions among themselves respecting the co-ordination of facilities and service, and the introduction of economies to the extent essential to guarantee the most economical administration and methods of transportation, under the system that is at present observed. Unless these conditions are recognized and relieved through definite organization, then transportation under private operation must fail."

The Board of Economics and Engineering is composed of John F. Stevens, F. A. Molitor, John F. Wallace, W. L. Darling, L. B. Stillwell, and W. W. Colpitts. Mr. Warfield said that several members of the board were present and would indicate briefly the directions the proposed investigations will take. Mr. Stillwell was to indicate the direction in which investigation will be made in respect to equipment.

Mr. Wallace was to discuss the joint use of terminals in larger cities. Edwin Ludlow, president of the American Institute of Mining and Metallurgical Engineering, was to discuss methods for joint coal and fuel purchases. Forney Johnston, of counsel for the association, was to describe the equipment agreements and contracts between the carriers and the service corporation.

Mr. Warfield stated that his association represented the holders of $11,000,000,000 of railroad securities, mostly bonds. Senator Cummins asked how these bondholders had selected the Board of Economics and Engineering. Mr. Warfield said they had been selected by the executive committee and were to be paid by voluntary subscriptions by members of the association. Senator Wolcott asked what was the attitude of the railroads toward the creation of this board. Mr. Warfield said that he thought the railroads would be willing to co-operate and that he could see no reason why they should not. Senator Cummins remarked that "to state it bluntly, the appointment of this board must be based on the thought that the railroads are not being properly managed and that they will accept the advice of this board and that the association must have had in mind that the railroads are not being as economically managed as possible." Mr. Warfield said there was no doubt about that, but that he thought that one difficulty of the present situation is that each executive is looking out for himself, but that he will welcome a plan of co-operation. He also said that in the event of consolidations it will be necessary to treat with the great bulk of the security owners. Senator Cummins said that if the railroads find it necessary to ask some indulgence from the security owners they will be able to get a hearing at any rate. Mr. Warfield said he desired to have W. A. Colston, director of the Bureau of Finance of the Interstate Commerce Commission appear before the committee to talk about the economies that can be effected through consolidation.

Report on Collision at Abermule

THE MINISTER OF TRANSPORT of Great Britain has issued a report, made by Col. J. W. Pringle, inspecting officer, on a disastrous butting collision of passenger trains on the Cambrian Railways at Abermule, Wales, on January 26, 1921, in which 11 passengers were killed and 36 persons, mostly passengers, were injured, three of these subsequently succumbing to their injuries. Abermule is about ten miles southwest of Welshpool and about four miles north of Newton; it is the junction of a branch to Kerry. The line is operated under the electric train-tablet system with Tyer's No. 6 instrument, which system has been in use 30 years; and the collision, one mile south of Abermule, was due to negligence in allowing the southbound train to enter the block section at Abermule with the tablet which had just been surrendered by that train (for the section north of Abermule). The trains met at about 25 or 30 miles an hour, and the engineman and fireman at fault were killed.

The inspector says that the engineman and fireman of the southbound train, Jones and Evans, should bear half the responsibility for the collision, holding also that if the engineman had been keeping a good lookout he could have applied the brakes so as to mitigate the effects of the collision. Both men evidently had accepted the tablet in a pouch without reading it. E. P. Rogers, a station porter, 17 years old, accepted the northbound train from the station to the south without authority from the station master or the signalman; and immediately after this he started for the south end of the yard to set the switch for the two trains to meet at Abermule. F. W. Thompson, ticket clerk, 15 years old, took the tablet from the southbound train, as it came in, this also without authority; and instead of putting the tablet into the instrument, he met the acting station master, Lewis, in the waiting room, and handed the tablet, in its holder, to him, asking him to change it. Thompson then went across the tracks to take up the tickets from incoming passengers from the north. Lewis assumed that Thompson had already changed the tablet and that he was receiving one for the section south of Abermule, and he gave it to the fireman, the engineman being engaged in oiling.

Rogers, at the south end of the loop, was surprised to find that he could not set the switch for the northbound train (the switch being controlled by a bolt lock from the signal cabin) but he saw the station master give a hand signal for the southbound train to proceed, and he assumed that the meeting place of the trains had been changed.

Several other irregularities are noted in the report and responsibility is placed on the acting station master, Lewis, Signalman Jones (60 years old) and the porter and the clerk. The regular station master, Parry, was on vacation; he is held responsible for the growth of these irregular practices, and in a less degree, the inspectors who had failed to detect them. Lewis, with Jones, is held responsible equally with the engineman and fireman. All of the rules which were violated are simple and well understood and of long standing; and, indeed, violations are so infrequent that the collision is characterized as unique in the annals of British railways. "Such indiscipline and slipshod methods would have been incredible prior to this collision."

Having set forth the facts the inspector feels so strongly that the rules will be observed in the future that he finds no justification for recommending additional precautions, except the following: at meeting points where the tablet instruments cannot be placed in the signal cabin there should be electric interlocking between the tablet instrument and the starting signal; in special circumstances such interlocking should be provided even where instruments are in the signal cabin. The switches at Abermule should be worked from the cabin; and the governmental committee which is now engaged in standardization of rolling stock should consider the question of equipping new passenger cars with buffers designed to prevent overriding of one car by another in case of collision.

The engineman and fireman of the northbound train, men of long experience, could not recall cases of enginemen or firemen who did not habitually read tablets handed to them. We find no mention of the age, character or experience of the engineman and fireman who were killed.

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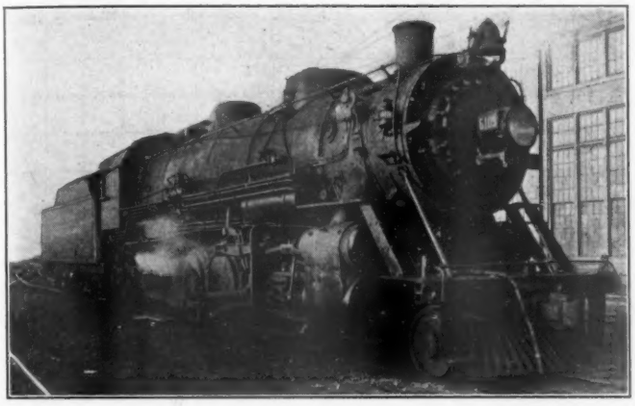
President Harding Leaving the Interstate Commerce Commission After His Call on June 1 for the Purpose of Inquiring as to the Progress Being Made in the Revision of Freight Rates

The Automatic Control of Locomotive Cutoff

Tests on Big Four Demonstrate Its Practicability, Utilizing Back Pressure as Actuating Force

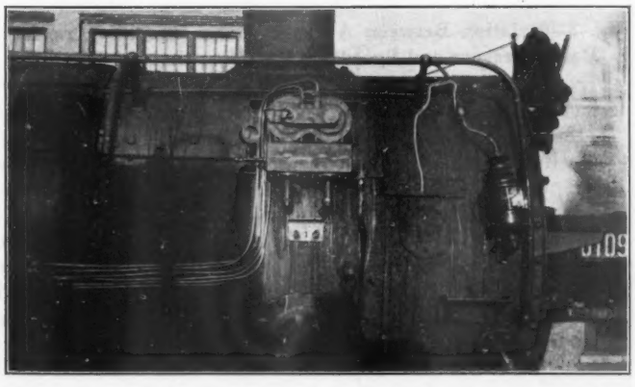
By E. S. Pearce
Mechanical Engineer, Cleveland, Cincinnati, Chicago & St. Louis

LOCOMOTIVE DRAW BAR pull is the result of steam pressure on the pistons. Variations in the amount of draw bar pull with changes in speed are the result of variations in the average pressure against the pistons, and changes in the average pressure against the pistons are the result of changes in the quantity, pressure and temperature of the steam admitted to the cylinders at the beginning of the stroke.



Mikado Locomotive Equipped for Automatic Control of Cut-Off

Graphically, the relation of quantity and pressure are represented by the indicator card. As shown by Fig. 1, steam is admitted to the cylinder from the point of admission A to the point of cutoff B, at a pressure of P lb. At the point B the amount of steam in the cylinder, for all practical purposes, is the amount used in the development of the work of one stroke. From B the steam expands the remainder of the



Differential Valves Connected to Exhaust Passages and to Reverse Gear

stroke to the point of release C. On the return stroke the steam is expelled from the cylinder between C and D to the point of compression. During the time this steam is being expelled it is exerting against the piston a back pressure P_2 tending to reduce the positive force of the steam against the opposite face of the piston.

The exhaust or back pressure, P_2, varies directly with the admission pressure P_1, the length of cutoff, speed and the ability of the boiler to supply steam at the rate required to maintain P_1. It varies indirectly with the size of exhaust ports and passages.

Fig. 1 shows the value of back pressure when a constant cutoff is used through a range of increasing speeds as compared to the changes that take place in the admission pressure. The admission pressure falls off with increasing speed due principally to the inability of the boiler to supply steam in such increasing quantity and also on account of the decreased time interval for admission. Back pressure increases with increased speed due almost entirely to the shortened time interval for the escape of the steam. The net effect of the change in P_1 and P_2 was to reduce the area of the indicator card, which is the measure of the average mean effective cylinder pressure.

From the indications of the card, it is reasonable to suppose that somewhere between 12 and 26 miles an hour a shortening of the cutoff would have produced a card of greater area, regardless of the fact that a lesser number of cubic feet of steam would have been admitted to the cylinders. This increased area would be due to the higher value of P_1 caused by the smaller demand on the boiler and there being

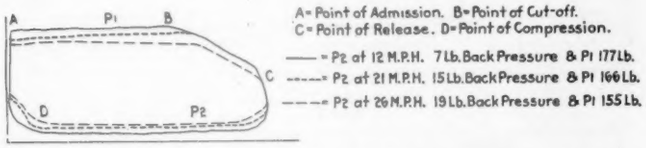

A
P1
B
C
D
P2
A= Point of Admission. B= Point of Cut-off.
C= Point of Release. D= Point of Compression.
—— = P2 at 12 M.P.H. 7 Lb. Back Pressure & P1 177 Lb.
------ = P2 at 21 M.P.H. 15 Lb. Back Pressure & P1 166 Lb.
– – – = P2 at 26 M.P.H. 19 Lb. Back Pressure & P1 155 Lb.

Fig. 1—Indicator Card Showing Relation Between Exhaust and Admission Pressure and Area with Fixed Cut-Off as Speed Increases

less steam in the cylinder to be exhausted the value of P_2 would be less. Should this supposition prove correct the decrease in drawbar pull would be less rapid and the amount of work per pound of steam used would be greater. Within the reasonable limits of practical application it is also possible that the exhaust pressure may bear a relation of a more or less constant nature to P_1, the point of cutoff and the speed, such that by adjusting the cutoff to hold the exhaust pressure at a constant value an indicator card of the maximum area will be obtained for each speed within the limits of the boiler capacity.

The theory so far advanced, if of any practical value, should easily be demonstrated by the analysis of actual road tests conducted for that purpose. Such tests have been conducted on the Big Four in which no refinements of observation or calculations were indulged in not within the reasonable limits of every day performance. The conclusions, therefore, are within the reasonable limits of practical application.

It is first necessary to determine just what relation cutoff bears to drawbar pull, then what relation mean effective cylinder pressure bears to cutoff, through the same range of speeds. These relations being established, the variation of exhaust pressure as related to speed, cutoff, or mean effective

cylinder pressure can easily be determined. Since the exhaust creates draft and draft supports combustion, which must go on at a certain rate to supply steam, the relation of exhaust pressure and draft must also be determined. Part of the heat of combustion is used in superheating the steam. Since the steam supply, as controlled by cutoff, bears a possible relation to exhaust pressure and since draft may also bear such a relation, it is essential that the relation of superheat to back pressure be determined throughout the working range of cutoffs.

For determination of the above relations and variations in each specific element, a stoker fired locomotive of the Mikado type with the following dimensions was used:

Cylinders	27 in. by 30 in.
Tractive effort	50,000 lb.
Diameter of drivers	63 in.
Steam pressure	200 lb.
Grate area	60 sq. ft.
Evaporative surface	4,650 sq. ft.
Superheat surface	1,163 sq. ft.
Weight on drivers	246,000 lb.
Valve gear, Walschaert.	

With respect to the relation of the position of the reverse lever to the amount of steam travel of the piston for several positions of the reverse lever, it should be noted that from the corner back to the third notch the cutoff was shortened .705 in., from the third to the sixth notch 2.135 in., and from the sixth to the ninth, the shortest cutoff, 5.74 in. The effect of one notch adjustment near the corner is, therefore, about one-eighth that of one notch near the center.

The range of speed through which one cutoff will maintain a greater drawbar pull than the next longer or shorter cutoff is very clearly shown in Fig. 2 by the relation of the drawbar pull-speed curves for the positions of cutoff with the reverse lever in the first, third, sixth and ninth notches. The extent to which the use of one cutoff through a considerable range of increasing speeds will tax boiler capacity is shown by the

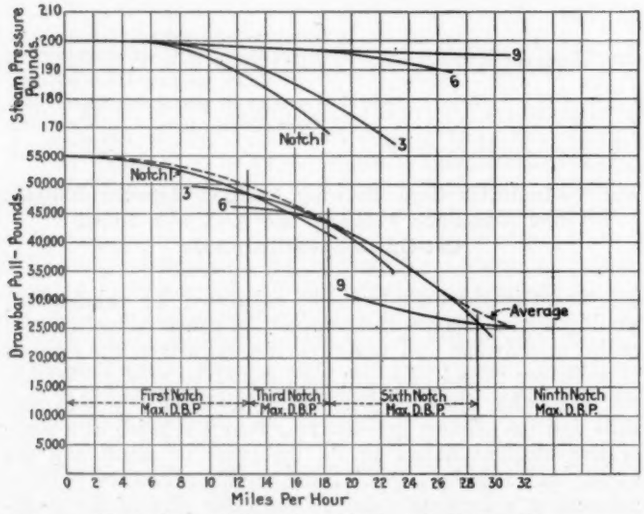


Fig. 2—Variation of Drawbar Pull and Boiler Pressure as Speed Increases with Four Positions of Cut-Off

rate at which boiler pressure falls off as speed increases. It is evident that using the incorrect cutoff when maximum capacity is required will not only prevent such capacity being developed, but will needlessly tax the steaming capacity of the boiler. Cutoff changes to develop maximum drawbar pull at each speed on this particular class of engine should be made as follows:

First notch, 89.1 per cent C. O.....0 up to 12-14 m.p.h.
Third notch, 86.75 per cent C. O....12-14 m.p.h. to 18-19 m.p.h.
Sixth notch, 79.65 per cent C. O....18-19 m.p.h. to 28-30 m.p.h.
Ninth notch, 60.5 per cent C. O.....28-30 m.p.h. up.

In actual practice with either increasing or decreasing speed this number of cutoff changes would not be made, although the advantage of so doing must be evident. In fact, the notches between those cited could be used with profit.

Mean effective cylinder pressure, back pressure and their relation to speed are shown in Fig. 3. Since mean effective cylinder pressure produces drawbar pull, the cutoff changes required to hold it at the maximum with changing speed should correspond to those required to hold drawbar pull at the maximum. From Fig. 3 these are found to be as follows:

First notch.....Up to 12-14 m.p.h.
Third notch.....12-14 m.p.h. to 15-16 m.p.h.
Sixth notch.....15-16 m.p.h. to 28-30 m.p.h.
Ninth notch.....28-30 m.p.h. and up.

The slight discrepancy in speed at the upper limit of the third notch and the lower limit of the sixth notch does not

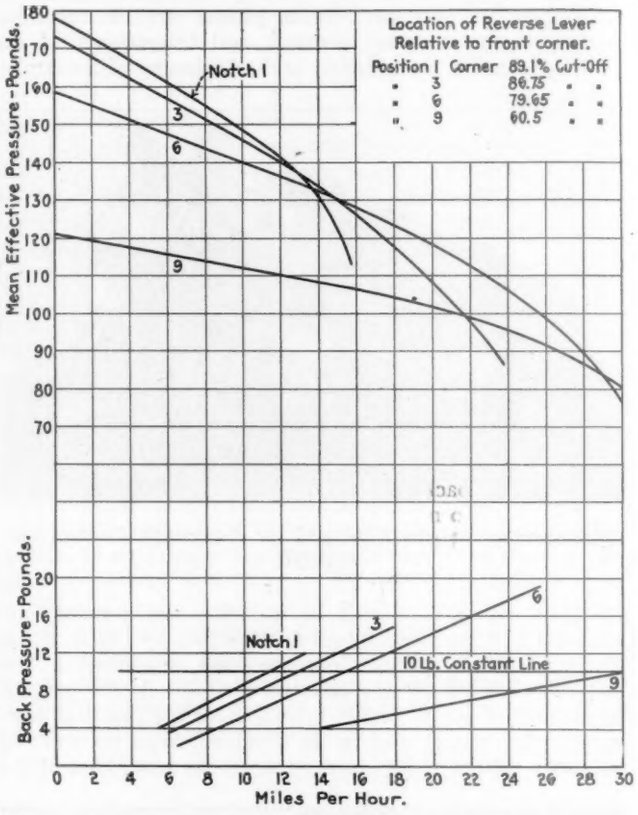


Fig. 3—Relation Between Average Mean Effective Pressure, Back Pressure and Speed for Four Positions of Cut-Off

detract from the theory and the fact that mean effective pressure falls off at a more rapid rate than boiler pressure, as shown in Fig. 2, while back pressure increases in practically direct proportion to increasing speed, is a practical demonstration of the theory set forth in connection with Fig. 1. Attention is called to the fact that the back pressure curve for each cutoff shows a value of approximately 10 lb. at the same speed at which the cutoff should be changed to hold mean effective pressure as well as drawbar pull at a maximum.

Since back pressure apparently bears some constant relation to mean effective cylinder pressure and thence, through cutoff, to drawbar pull, there must be some point of maximum return to be expressed in pounds mean effective cylinder pressure per pound of back pressure. Fig. 4 shows the ratio of mean effective pressure to pounds of back pressure for the various cutoffs and back pressures. The longest cutoff gives the maximum return in pounds mean effective pressure per pound of back pressure up to a point between 10 and 12 lb. back pressure, which occurs for this cutoff at 12 to 14 miles an hour. All values of cutoff show that with 10 to 12 lb.

back pressure the pounds mean effective pressure per pound of back pressure are approximately the same. Therefore, if each cutoff is changed when a speed is reached such that back pressure has reached between 10 and 12 lb., the maximum

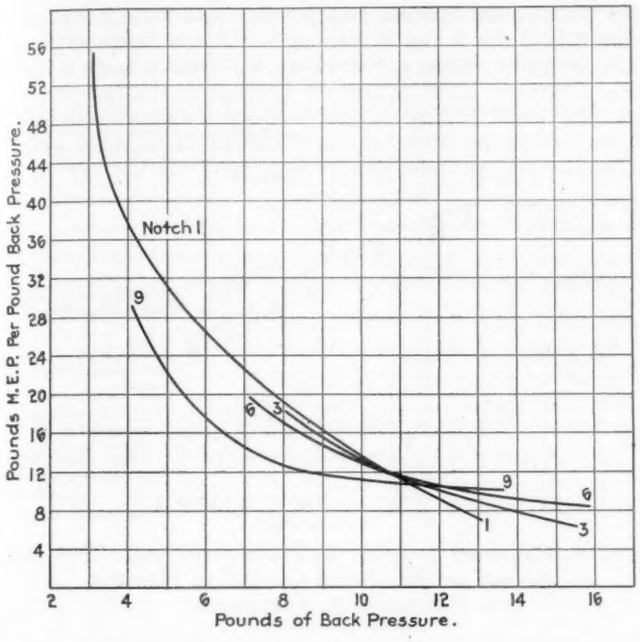


Fig. 4—Average Pounds Mean Effective Pressure Per Pound Back Pressure for Four Positions of Cut-Off

return for the back pressure carried will be obtained, both in economy as to mean effective pressure and capacity as to the drawbar pull obtained as a result of the change. That

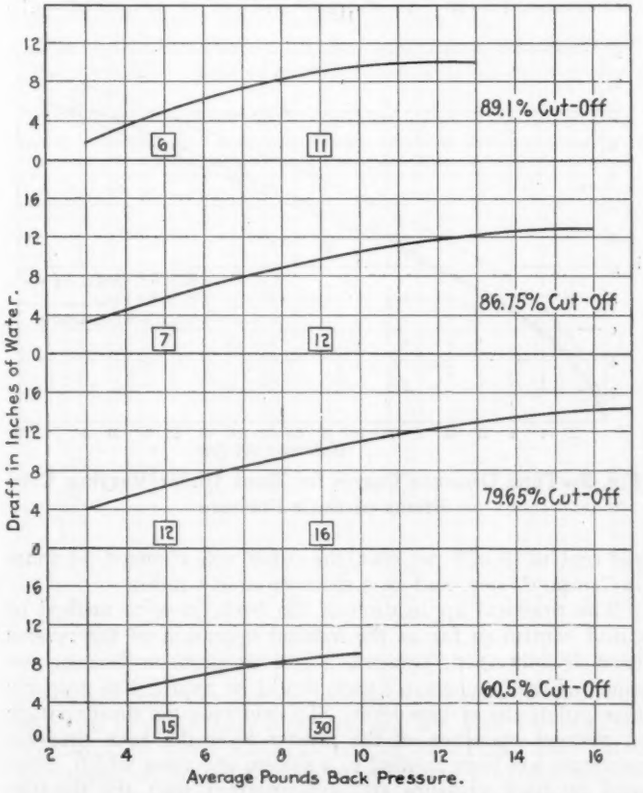


Fig. 5—Back Pressure and Average Draft at Base of Stack for Four Positions of Cut-Off with Varying Speed

10 to 12 lb. back pressure is the point of maximum return is still further evidenced by the fact that the relative positions of the several curves in Fig. 4 are reversed on either side of this critical range.

The relation of draft to back pressure is shown in Fig. 5. Dr. Goss in his book on "Locomotive Performance," states that:

"First—Changes in cutoff have no effect upon the form and character of the jet, except insofar as they affect the quantity of steam discharged.

"Second—With a given weight of steam discharged, whether in heavy exhausts incident to low speed, or the more rapid impulses at high speed, the draft resulting is practically the same. But whenever the weight of steam discharged per minute changes, the draft will change.

"Third—In any boiler the condition of draft determines the rate of combustion and consequently under ideal conditions, the draft will be a function of the rate of combustion."

From Fig. 5 it will be seen that for all of the cutoffs shown, constant back pressure is synonymous with constant draft. This seems to be contradictory to the first and second con-

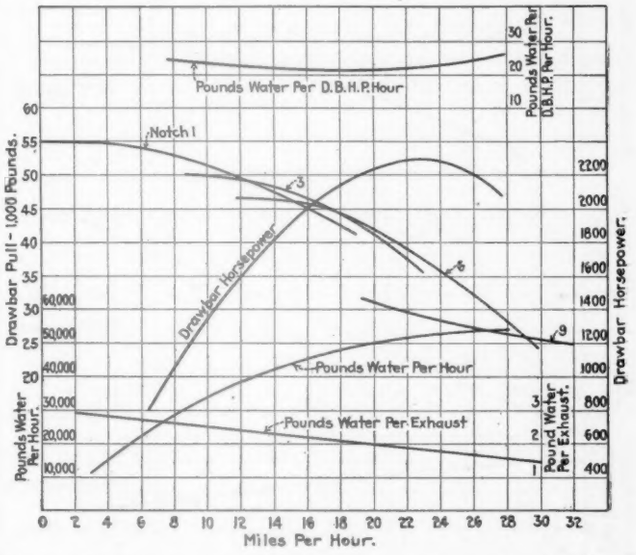


Fig. 6—Drawbar Pull, Horsepower and Water Rate Cut-Off Adjusted for Varying Speed, as Shown in Fig. 2

clusions of Dr. Goss since as speed increases and cutoff is shortened, the quantity of steam exhausted per minute increases with speed as shown by Figs. 6 and 7. It should be noted that as cutoff is shortened with increased speed the amount of steam discharged per exhaust decreases from 2 miles an hour to 28 miles an hour by 45.8 per cent, whereas the quantity per minute increases over the same range by 1,460 per cent. At low speeds the intervals between exhausts is large and the quantity of steam discharged per exhaust is also large. At high speeds the intervals between exhausts is small and the quantity of steam discharged per exhaust is also small. Low frequency and high quantity in one case is equalled by high frequency and small quantity in the other; the result is a constant.

Constant draft through a range of speed requiring an increasing rate of steam supply and consequently an increasing rate of combustion if steam pressure is to be maintained within working limits, may seem to be contradictory to the third deduction made from the experiments of Dr. Goss. Analysis of the conditions of actual operation very easily explains the consistency of both statements. To supply steam at low rates a heavy fire is used, giving greater resistance to the passage of a given quantity of air through the fuel bed

in a given time, hence a high draft is required although less air is required in a given time than at high speed. To supply steam at high rates a light fire is used with lower resistance to the passage of the air, yet the quantity of air required in a given time is greater than at low speed. For all practical purposes draft is constant for varying rates of combustion and the air supply automatically controlled by the thickness of the fuel bed.

The statement that conditions of operation actually require constant draft is further substantiated by the relation of superheat to back pressure. Shortening the cutoff to hold back pressure constant as speed increases results in constant draft and as a result of this regulation of the quantity of steam passing through the superheater, practically a constant amount of superheat is obtained throughout a great range of speed. For back pressures from 8 to 13 lb. the superheat is the same. The higher back pressure is the maximum of economical return in draft and the range is within that obtained with low as well as high speed.

In summing up the analysis of back pressure and the relation of back pressure to the several features of locomotive operation it would seem that operating an engine to constant back pressure should regulate the cutoff to sustain the maximum drawbar pull at all speeds and consequently develop the maximum drawbar horse power at each speed; and that in developing the maximum drawbar horse power at each speed the required number of pounds of water per drawbar horse power would be supplied, the draft and superheat being so regulated that the boiler would maintain adequate working pressure.

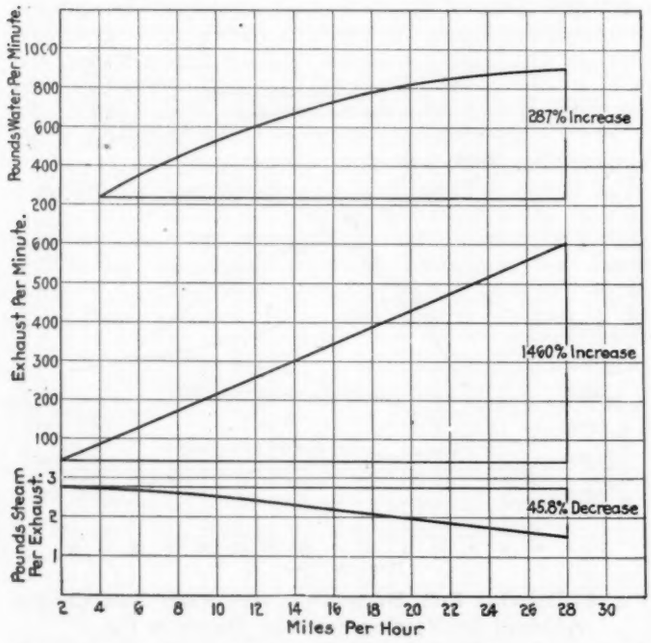


Fig. 7—Total Rate of Steam Discharge Per Minute. Cut-Off Changed at Speeds as Shown on Fig. 2

With the pressure, volume, and temperature of the steam used in a given time known, it is possible to calculate the weight of steam used within practical limits of accuracy, which is sufficient for comparing the steam consumption per unit of work at one speed with that at another. From the indicator card the volume of the steam and the average pressure at the point of cutoff can be obtained. The temperature of the steam may be that shown by the pyrometer, which will give the degrees superheat over the saturated temperature at the cutoff pressure, or the total superheat over the saturated temperature at cutoff may be assumed as that of the saturated temperature at boiler pressure plus the degrees superheat indicated by the pyrometer. In either case the error is negligible. From the data shown on Fig. 6 and previous charts, such calculations may be made.

Applying this method of calculation, the amount of steam per minute, per exhaust and per drawbar horsepower-hour shown in Table I and in Figs. 6 and 7 have been obtained. The water or steam per drawbar horsepower hour is well within the limits of economical performance and at the maximum is within the limit of economical combustion.

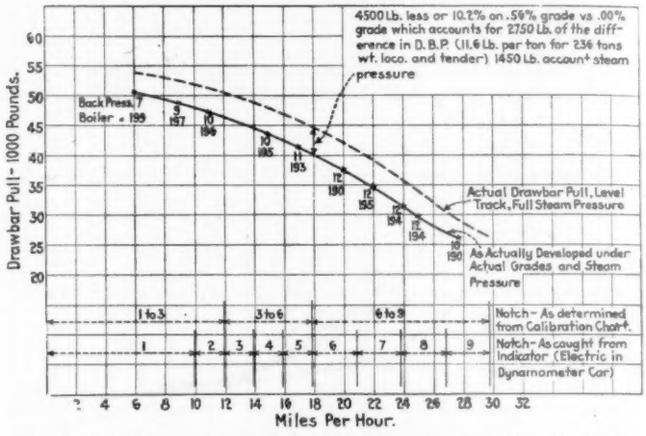

4500 Lb. less or 10.2% on .59% grade vs .00% grade which accounts for 2750 Lb. of the difference in D.B.P. (11.6 Lb. per ton for 236 tons wt. loco. and tender) 1450 Lb. account steam pressure
Back Press. / Boiler = 199
Drawbar Pull - 1000 Pounds.
Actual Drawbar Pull, Level Track, Full Steam Pressure
As Actually Developed under Actual Grades and Steam Pressure
1 to 3
3 to 6
6 to 9
Notch - As determined from Calibration Chart.
Notch - As caught from Indicator (Electric in Dynamometer Car)
Miles Per Hour.

Fig. 8—Maximum Drawbar Pull Compared with That Developed by Regulating Cut-Off to Maintain Constant Back Pressure

The ability of the engine to maintain steam pressure when operated at 10 to 12 lb. back pressure and the extent to which the maximum drawbar pull will be developed at each speed is shown in Fig. 8. In the operation of the reverse lever to hold the back pressure constant, accelerating a maximum tonnage train from 3 to 28 miles an hour on grades of —.13 per cent to +.629 per cent, the cutoff was changed 14 times in 7 min. 23 sec. and in a distance of 2.4 miles.

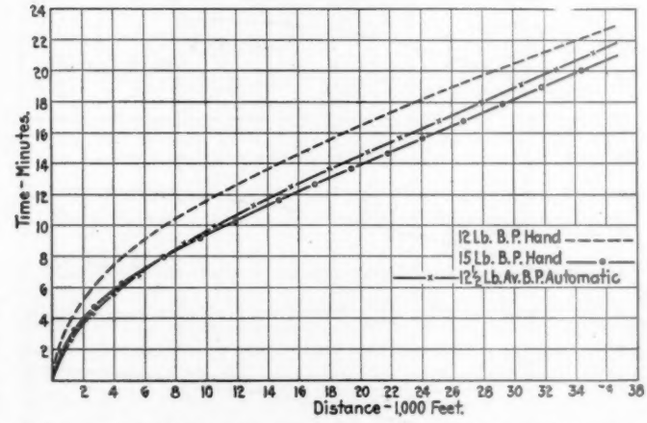


Fig. 9—Time Distance Curves for Runs Under Varying Conditions of Back Pressure

The practical application of the back pressure method of cutoff control so far as the manual operation of the reverse lever is concerned, presents a serious problem because too much of the engineman's time would be required to properly manipulate the reverse lever. To overcome the disadvantage of manual operation of the reverse lever the back pressure principle has been applied to a system of valves which, actuated by back pressure and synchronized with the throttle, automatically operates a power reverse gear to adjust the cutoff and thereby relieve the engineman.

Automatic operation of the reverse lever possesses mechanical, economical and capacity increasing advantages, and it is also on the side of safety. Mechanically the advantages are independence of valve setting, reach rod length or fineness of the quadrant notches, and the elimination of mechanical appliances for the indication of speed, making the adjustment independent of conditions of wear, which would tend toward the inaccuracy of a mechanical speed actuated device. Economical advantages are the operation of the unit to the maximum economical capacity as to hauling light trains or heavy trains at the speeds consistent with the loading, and uniform and synchronous operation with respect to steam

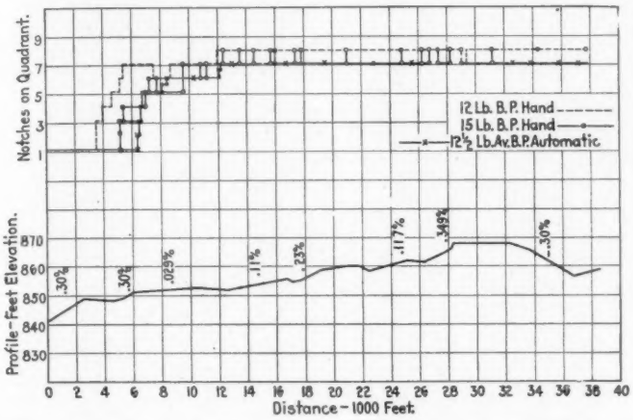


Fig. 10—Profile and Reverse Lever Positions for Runs Shown in Fig. 9

generation and consumption, draft, cutoff, superheat, and drawbar pull. From the standpoint of safety, the advantages are—relief for the engineman from a time absorbing duty, permitting concentration upon such other operating duties as the water, sand, throttle and signals.

The automatic device for the adjustment of cutoff consists essentially of three parts. Two differential valves set

TABLE I—COMPARISON OF STEAM CONSUMPTION IN LB. PER MINUTE AS CALCULATED FROM INDICATOR CARD BY

(1)—PRESSURE AND TEMPERATURE AT CUTOFF, PLUS 250 DEG. SUPERHEAT, AND

(2)—PRESSURE AT CUTOFF AND TEMPERATURE AT BOILER PRESSURE, PLUS 250 DEG. SUPERHEAT

Miles per hour	Revolutions per minute	Volume of four cylinders per revolution at % cutoff	Cubic feet steam per minute	Cu. ft. steam per pound at cutoff pressure plus 250° superheat	Pounds steam per minute	Pounds steam per exhaust	Cu. ft. steam per lb. at cutoff pressure and temperature at boiler pr., plus 250° s.h.	Pounds steam per minute	Pounds steam per exhaust	Exhausts per minute
2	10.7	35.4	379	3.2	118.5	2.75	3.2	118	2.75	42.8
4	21.4	35.4	757	3.28	231	2.7	3.28	231	2.7	85.6
6	32.0	35.4	1130	3.34	338	2.66	3.4	332	2.59	128.0
8	42.7	35.4	1510	3.5	430	2.53	3.46	436	2.86	170.8
10	53.5	35.4	1890	3.6	525	2.45	3.6	525	2.45	214.0
12	64.0	35.4	2260	3.7	610	2.38	3.8	595	2.32	256.0
14	74.8	34.5	2580	3.89	663	2.21	4.0	645	2.16	299.0
16	85.5	34.5	2950	4.05	728	2.13	4.1	720	2.1	342.0
18	96.2	34.5	3320	4.2	790	2.06	4.3	772	2.01	384.0
20	107.0	31.6	3380	4.4	767	1.79	4.5	780	1.75	428.0
22	117.5	31.6	3710	4.6	807	1.72	4.7	790	1.68	470.0
24	128.5	31.6	4070	4.8	849	1.65	4.9	830	1.615	514.0
26	138.0	31.6	4360	5.0	872	1.58	5.2	840	1.53	552.0
28	156.0	31.6	4920	5.5	895	1.49	5.7	865	1.44	600.0

Note—Cutoffs and speeds as shown in Fig. 2.

one pound apart are provided, one for shortening the cutoff when the back pressure increases, and the other for lengthening the cutoff when the back pressure decreases. Both valves are connected to the four exhaust passages of the cylinder saddles and to the air supply for the power reverse gear. A circular quadrant and cutout valve are so arranged that a finer cutoff than the engine will practically operate under at high speeds cannot be obtained. The circular quadrant permits the reverse lever to follow the gear and indicates the cutoff and also serves as a quadrant for the reverse lever when under hand control. A control valve is connected to the throttle so that the engine is placed in automatic cutoff and the reverse lever cannot be manipulated by hand when a full throttle is used. At any predetermined speed the throttle may be manipulated to restore hand control and with a small throttle opening, such as used in the movement of the engine alone or the engine and a few cars, the reverse lever may be manually operated.

Three comparative tests to determine the advantages of automatic operation were conducted under constant conditions of train loading, grade and direction. In the first test, the reverse lever was operated by hand to hold 12 lb. back pressure and the time to cover a given distance, while accelerating the train from a stand, was recorded. The second test was the same except that 15 lb. back pressure was to be maintained. The conditions of the third test were the same except that the reverse lever was automatically operated to maintain 12½ lb. back pressure. All tests started from the same point and a full throttle was required. The train consisted of 55 loaded cars of 3,479 tons actual weight.

Fig. 9 is the time-distance chart of these runs, which shows that six miles was covered in 20.9 min. in the first

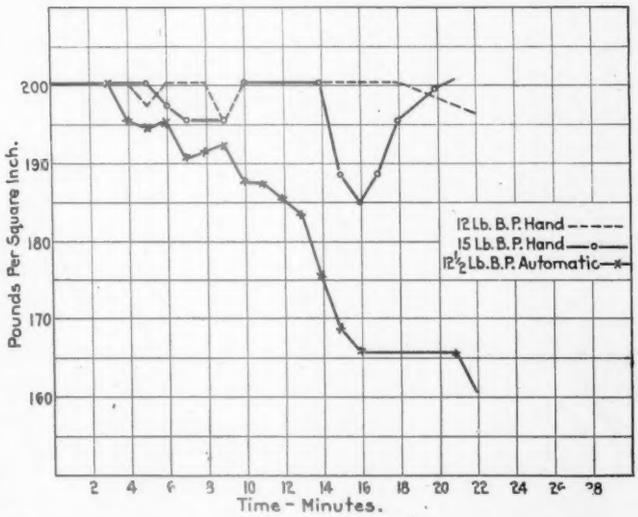


Fig. 11—Steam Pressure on the Three Runs Shown in Figs. 9 and 10

test, in 18.5 min. in the second test and in 19.3 min. in the third test.

Fig. 10 shows the rate at which the cutoff was changed and the nature of the grades negotiated. In the first 10,000 ft. seven adjustments were made in 11.4 min., or one every 1.6 min., in the first test; six adjustments were made in 9.0 min., or one every 1.5 min., in the second test, and in the third test six adjustments were made in 9.4 min., or one every 1.56 min.

Some time had elapsed between the first and third tests and as a result, the condition of the fire in the test of the automatic device was not as conducive to good steam pressure as in the two previous tests. Since this condition, however, is to be expected no steps were taken to better it. Fig. 11 shows the steam pressure conditions under which the three tests were run and explains why the automatic device held the engine in the corner longer than was required in the first two tests and did not hook back to the same short cutoff that was obtained in the other tests. It is remarkable, how-

ever, that in spite of the lower steam pressure the performance practically equalled the first two tests.

The modern locomotive with all the capacity and economy producing specialties and features of design may be divided into two parts by a line extending horizontally under the fire box and through the valve, from tender end sill to pilot beam. Above this line there is every development to produce steam economically and in quantity. Below this line there is every development to utilize the steam and the potential capacity of the entire machine in the production of drawbar pull and gross ton miles—the ultimate justification for the investment The extent to which the ultimate return in capacity and economy is realized depends upon the element of personal skill of the engineer.

The function of cutoff adjustment is the accurate and constant transfer of energy and the extent to which accuracy and constancy are obtained is the measure by which net return is realized.

Freight Car Loading

WASHINGTON, D. C.

FREIGHT CAR LOADING during the week ended on June 11 was the heaviest reported this year, according to the weekly report of the Car Service Devision of the American Railway Association, a total of 788,997, as compared with 930,976 in 1920 and 807,205 in 1919. This represents a gain of 1.760 as compared with the week before the May 30 holiday, although it is still behind the figures for 1919. For the week ending June 4 the loading was only 706,508 cars, as compared with 828,907 in 1920 and 776,610 in 1919, but the reduction is attributed to the holiday.

The freight car surplus for the week of June 15 showed a further reduction of 7,780 to 381,746 cars, of which 143,935 were box cars and 159,448 were coal cars.

The summary for the week of June 4 and the summary for the following week are given below.

REVENUE FREIGHT LOADED AND RECEIVED FROM CONNECTIONS

Summary—All Districts; Comparison of Totals This Year Last Year, Two Years Ago, for Week Ended Saturday, June 4, 1921

Districts	Year	Grain and grain products	Live stock	Coal	Coke	Forest products	Ore	Mdse. L. C. L.	Miscellaneous	Total revenue freight loaded: This year, 1921	Corresponding year, 1920	Corresponding year, 1919	Received from connections: This year, 1921	Corresponding year, 1920	Corresponding year, 1919
Eastern	1921	6,347	2,359	36,092	1,028	5,342	2,511	51,108	60,316	165,103			180,576		
	1920	4,518	2,396	46,457	3,523	7,308	6,089	21,519	98,212		190,022	197,354		230,513	200,300
Allegheny	1921	2,810	2,823	43,890	2,227	2,690	6,244	40,831	44,620	146,135			101,525		
	1920	2,395	2,712	48,407	5,933	3,384	10,670	37,277	65,362		176,140	159,701		157,404	113,118
Pocahontas	1921	154	150	23,014	33	1,350	23	2,379	4,791	31,894			13,721		
	1920	90	131	18,243	645	2,049	229	176	9,292		30,855	34,773		20,027	16,705
Southern	1921	4,238	1,980	19,416	448	14,470	582	35,258	31,002	107,394			58,970		
	1920	2,890	2,177	22,376	172	16,403	3,117	23,452	47,362		117,949	110,861		72,428	60,564
Northwestern	1921	11,086	6,021	4,759	626	14,121	17,708	24,994	28,526	107,843			40,113		
	1920	8,297	6,760	6,324	1,111	17,760	45,562	19,604	39,485		144,903	138,225		59,210	47,759
Central Western	1921	12,092	8,257	12,252	156	4,255	519	26,271	30,542	94,344			43,332		
	1920	7,605	9,277	20,455	477	5,152	4,946	28,031	36,360		112,303	89,024		70,229	50,395
Southwestern	1921	4,667	2,449	3,251	122	5,999	724	14,405	22,178	53,795			40,317		
	1920	3,371	2,236	5,757	132	6,204	817	15,120	23,098		56,735	46,672		47,898	35,890
Total all roads	1921	41,394	24,039	142,674	4,642	48,227	28,311	195,246	221,975	706,508			478,554		
	1920	29,166	25,689	168,019	11,993	58,260	71,430	145,179	319,171		828,907			657,709	
	1919	32,323	27,184	170,046		58,991	59,552		428,514			776,610			524,731
Increase compared	1920	12,228						50,067							
Decrease compared	1920		1,650	25,345	7,351	10,033	43,119		97,196	122,309			179,155		
Increase compared	1919	9,071			4,642			195,246							
Decrease compared	1919		3,145	27,372		10,764	31,241		206,539	70,102			46,177		

L. C. L. merchandise loading figures for 1921 and 1920 are not comparable, as some roads are not able to separate their L. C. L. freight and miscellaneous of 1920. Add merchandise and miscellaneous columns to get a fair comparison.

May 28	1921	46,337	27,518	164,870	5,605	50,277	28,673	215,095	248,862	787,237	898,207	763,761	519,191	676,601	550,858
May 21	1921	37,252	26,368	158,512	5,337	50,216	30,214	216,030	244,401	768,330	862,074	777,324	508,969	666,585	557,879
May 14	1921	34,418	25,599	161,782	5,126	49,365	22,806	215,524	235,538	750,158	843,145	739,945	501,228	620,196	540,955
May 7	1921	34,847	27,123	143,323	4,626	48,095	13,041	213,535	233,435	718,025	843,184	753,287	495,386	594,418	549,712

REVENUE FREIGHT LOADED AND RECEIVED FROM CONNECTIONS

Summary—All Districts, Comparison of Totals This Year, Last Year, Two Years Ago. Week Ended Saturday, June 11, 1921.

Districts:	Year	Grain and grain products	Live stock	Coal	Coke	Forest products	Ore	Merchandise L.C.L.	Miscellaneous	Total revenue freight loaded: This year 1921	Corresponding year 1920	Corresponding year 1919	Received from connections: This year 1921	Corresponding year 1920	Corresponding year 1919
Eastern	1921	6,895	3,239	44,309	1,032	6,266	2,369	58,489	72,411	195,010			195,410		
	1920	5,607	2,873	56,597	3,000	8,445	7,806	25,568	113,493		223,389	203,550		250,086	215,130
Allegheny	1921	3,041	3,630	52,497	2,372	2,973	6,973	43,859	52,797	168,142			109,477		
	1920	2,710	3,555	56,398	5,849	3,539	11,084	42,522	73,987		199,644	167,189		145,985	121,311
Pocahontas	1921	181	153	23,724	55	1,416	26	2,636	5,189	33,380			14,262		
	1920	157	118	18,312	631	2,157	220	129	10,312		32,036	32,981		22,580	15,900
Southern	1921	3,664	2,302	19,796	441	14,608	787	38,291	32,375	112,264			59,868		
	1920	3,291	2,185	23,092	238	16,690	3,494	25,908	51,541		126,439	112,348		79,768	58,058
Northwestern	1921	11,647	7,436	5,331	619	14,751	18,741	27,714	31,651	117,890			34,745		
	1920	9,785	6,856	8,405	1,209	18,171	46,942	22,501	42,782		158,651	146,324		61,932	52,848
Central Western	1921	10,783	9,811	13,324	135	5,076	541	29,100	36,148	104,918			46,203		
	1920	9,211	9,845	22,955	528	6,684	4,635	31,504	43,284		128,646	100,680		72,773	59,245
Southwestern	1921	4,908	2,564	4,107	134	6,303	742	15,651	22,984	57,393			41,364		
	1920	3,647	2,159	5,735	88	7,292	843	16,505	25,902		62,171	44,133		48,390	41,346
Total, all roads	1921	41,119	29,135	163,088	4,788	51,393	30,179	215,740	253,555	788,997			501,329		
	1920	34,408	27,591	191,494	11,543	62,978	75,024	164,637	363,301		930,976			681,514	
	1919	31,352	27,132	171,820		59,463	65,874		451,564			807,205			563,838
Increase compared	1920	6,711	1,544					51,103							
Decrease compared	1920			28,406	6,755	11,585	44,845		109,746	141,979			180,185		
Increase compared	1919	9,767	2,003		4,788			215,740							
Decrease compared	1919			8,732		8,070	35,695		198,069	18,208			62,509		

THIRTY CENTS FOR A POTATO is the gravamen of a complaint made against a Canadian dining car by Hon. John Oliver, Premier of British Columbia, recently; and, says the minister, the farmers are selling them at 35 cents a sack. Mr. Oliver made this complaint, however, to a reporter, not to the railroad; and he turned at once to more serious matters. He says that this is going to be one of the best and one of the worst years for the farmer. Canada never gave such a promise of good crops as this year. "There'll be splendid crops, bar accidents. But prices! Well, I don't know what the farmer is going to do this year. A farmer in Ontario told me that he was getting only $7 a can for his cream. It dropped from $22 to $7 in six weeks. It looks as if this is going to be a year of difficulty for the farmer in spite of potatoes at 30 cents apiece on the trains."

Co-ordinating Motor Trucks With Railroads*

Opportunities for Highway Transportation to Develop New Traffic Instead of Merely Competing with Existing Lines

By Stuart B. Moore
Formerly Construction Engineer, Southern Pacific Lines—Atlantic System

I ASSUME it is generally admitted that traffic should move by the most economical route and that in considering the cost of motor truck ton-miles all items of cost should enter into the motor truck ton-miles. The layman is prone to figure the cost of motor truck service as the cost of wages, fuel and maintenance of equipment, plus a profit for the concern operating the truck line. If the proper charge were added for the damage that the motor truck does to the highway, plus an interest charge on the property investment, the cost of motor truck service would immediately become prohibitive. However, I want to make clear that this argument is not intended to discourage motor transport but on the contrary it is hoped that a way can be pointed out that will greatly extend the use of motor driven vehicles as an aid to our railroads instead of a competitor.

Motor Transport Now Unregulated

Motor transport as it exists today is totally unregulated from an operating standpoint. There is no prohibition against anybody running a motor truck of any weight, anywhere, regardless of danger to the roads when considered as a structure being able to stand this loading. It is a matter of common knowledge both to the lay and professional minds of the country that the loading of our motor transport is greatly in excess of the strength of our roads, yet no one does anything about it and the evil grows unchecked.

The main highways of today were originally located adjacent to the lines of railroad when the country was sparsely settled and without any view to bringing traffic to the railroads. It is on these highways that we are spending a very large proportion of the road funds today. The function of motor transport is to feed the railroads and not to compete with them and as this is quite generally acknowledged why should we spend most of our road funds on parallel highways and almost totally exclude tributary highways?

The economic theory of railroad and highway location demands that main highways that are built to carry heavy motor traffic should be across the main lines of railroads and should not parallel individual lines of railroads as is now too frequently the case. If the present policy of subsidizing parallel lines of highways whose only service is to compete with the railroads, instead of highways that radiate from transportation centers is continued this policy will certainly result in crippling of our transportation system. It is true that the railroads are here and cannot be removed but it is also true that good service is required, that terminal improvements are urgent and that new and additional equipment is essential if our transportation machine is to function properly. These things are essential and require money, and lots of it, and with the operating ratio of many of our best and most efficient carriers close to 100 per cent the chance of the public through the carriers obtaining these things is not good to say the least.

How Highways Can Best Serve the Public

It is, however, possible for the highways of this country to be located so as not only to serve the people to a much better advantage but also to assist the railroads to get adequate returns as well as to stimulate very greatly motor transport.

Assuming that a transportation center—and any thriving town surrounded by a farming community or in which industries are located may be considered as such—had a system of good roads radiating from it so that the back areas were as available to the benefits of the city as the locations closer in, it would be possible for motor transport to be developed so that freight could be collected at either the farm or the factory and the bill of lading issued at once by the concern handling the motor transport. The merchandise thus collected could be delivered to the railroad which would haul it to its destination and would in turn be delivered to the motor transport company that would operate in the section to which the freight was destined and would be delivered to its final destination after having been handled throughout by the utmost economy and dispatch.

I of course do not mean to suggest that highways between large centers be not maintained to a high degree of excellence but I do affirm that it is unnecessary to construct these highways so that gasoline locomotives can be operated over them and that the major portion of the road funds available be consumed in their construction and maintenance to the detriment of the tributary territory.

To one familiar with the transportation business many things are obvious. The roads would have to be designed to carry a pre-determined load; and having been built in accordance with this design the load that the structure was designed for could not be exceeded without promptly destroying the structure. Heavy loads could of course be moved over the highways, but the manner in which these loads could be moved would first have to be regulated by the central authority in the district charged with this function of highway administration. If the railroads attempted to run their heavy locomotives indiscriminately over their branch and main lines they would be out of service the first day that such a policy was attempted.

Some definite policy of maintenance would of course have to be insisted upon and the roads of the district should preferably be of a common standard design so as to simplify the maintenance to as great a degree as possible.

The co-operation of the manufacturers of motor truck companies could be secured so that they would refuse to sell in a community a truck that was heavier than the roads in that particular district would carry.

The question as to who would administer a given district in such a manner naturally comes next. The talent to do so is found only in the railroad service and beyond any question the carriers would have to establish a department to cooperate with the local public officials; this department of the railroad functioning under the direction of some public body which would have the power of enforcing or annulling the carriers' suggestions for the handling of the traffic of the district.

The Federal Highway Council of Washington, D. C., has decided that "The encouragement of highway transportation beyond highway development is dangerous. It will discourage the use of motor trucks. Highway transportation will follow highway development but it cannot lead." As this is a strictly true statement and as it can be shown that an

*From a statement given to the Senate Committee on Interstate Commerce.

adequate system of rural roads of present types that are suitable to stand even light motor trucks is impossible on account of the cost being in excess of what the more sparsely settled communities can bear, a discussion of this sort would be visionary in the extreme if a design for a road that would fulfill the above requirements were not submitted to support the preceding analysis of our motor-transport-railroad situation.

When we come to consider hard surfaced roads we must discard all but one type for general use on our country roads outside of thickly settled communities on account of their cost. This is the surface treated road or as the laymen frequently miscall them, Tarvia roads. In considering this type we are immediately confronted with the fact that the life of this road is but a year and were we to pause here we should be forced to also discard this type on account of its high annual cost.

A careful investigation of this type of road reveals that the reason for the early failure of these roads is that traffic develops a well defined path which is in reality a slight rut and as almost the entire wear occurs in this rut, in the course of a year's time small holes wear through the thin asphaltic surface and as a consequence water is thus admitted to the subgrade. These wet places become soft places and the soft places under traffic quickly become low places and the low places produce impact and the entire rut is then quickly pounded to pieces and unless prompt and extensive repairs are made the road is destroyed.

As this type of road fails because the rut is not only the weak spot, but the very weak spot, a type of roadway has been developed that takes advantage of the psychology of the situation and recognizes the human tendency to follow a rut and furnishes the rut for traffic to follow and places a foundation under the rut so that the rut instead of being the very weak spot becomes the very strong point in the road. The rut (reinforced tracks sunk below the surface) is of course not made deep enough to interfere with a car turning out to meet or pass another car. On roads that have a heavy traffic in both directions the highway should be double tracked.

This road is not a visionary project by any means as it has been approved by the Bureau of Standards in Washington, the Federal Highway Council, spoken of favorably by the Bureau of Public Roads, and Julius Kruttschnitt, chairman of the board of the Southern Pacific Railroad, has gone into the matter and expressed a favorable opinion of the design and his interest in the initial installations.

International Equipment Association Proposed

WASHINGTON, D. C.

ESTABLISHMENT of an international railroad equipment association to finance the sale of equipment to railroads has been put forward by the American Committee on Land Transportation for consideration at the first annual meeting of the International Chamber of Commerce in London during the week of June 27. This proposal has been made to Walker D. Hines, formerly head of the United States Railroad Administration, who as chairman of the International Chamber railroad group asked for suggestions from the American committee in the formation of the program for the London conference.

The committee believes that the organization of an equipment pool would be an important step toward relieving a critical situation, which is one of the underlying causes impeding the restoration of the world's commerce. In its report to Mr. Hines, who has been in Europe for the past year, the committee says that "in view of the shortage of capital in foreign countries it is probable that the additions and betterments of the physical railroad properties and the necessity for increased equipment cannot be locally financed for some time. We suggest that negotiations be entered into with a view to bringing American bankers and the fiscal heads of the nations interested together for the purpose of organizing an International Equipment Association. It would be the purpose of this association to furnish funds for equipment required, to the extent of perhaps 75 per cent of its value, with notes guaranteed by the government of the country concerned in the transaction; an initial payment of 25 per cent to be made by the purchaser."

At the same time, the American committee proposed to Mr. Hines "that it might also be desirable to organize a railroad construction and development association financed in America upon lines similar to those suggested for the equipment association. It would be the purpose of such association to undertake any needed extensions and development of railroad lines in foreign countries."

The committee's report gave considerable attention to the removal or simplification of frontier restrictions which delay either rail or water transport. "It is suggested by this committee," the report says, "that consideration be given to prevailing practices in the United States as related to international commerce between Canada and the United States, between Mexico and the United States, and between Mexico and Canada via the United States, under which system of documentation the local regulations of Canada, Mexico, Cuba and the United States as subordinated to well-defined regulations applying purely on through traffic, as under this system the delay at frontiers is minimized.

"The necessary, international shipments are carried forward under bond, the settlement being made at the established ports of entry in the several countries. Under this plan, the delay at the frontier is only that which is necessary for the proper protection of the customs revenue of the respective government."

The committee recommended the consideration of the possibility of creating at each port a port terminal zone under one authority whereby freight interchanged between the rail lines and the vessels shall be under a joint supervision and interchange of documents which will protect equally both the rail lines and the water carriers.

Another general topic of substantial importance considered by the American committee was that of international bills of lading. In answer to the question "is there any form of international bill of lading which at present is regarded as a standard and which ought to be put forward for endorsement by the London Congress?" the committee says: "The United States bill of lading is applicable on traffic between the United States, Canada and Mexico, and it is susceptible of adaptation to all international traffic. It is considered highly essential that such form of international bill of lading shall be put into effect."

The committee strongly recommended the use of an international uniform railroad gage as an important step toward improving railroad transportation between the various countries.

THE LOSS AND DAMAGE claim prevention committee of the Middle Division of the Pennsylvania Railroad has been making a "drive" against poor stowing and rough handling and to abolish the waste of money due to carelessness. Members of the committee are much pleased with the way the men have responded to their solicitation for help. William Elmer, superintendent of the Middle division, addressed the Kiwanis and Rotary clubs at their luncheons in Altoona recently in connection with the drive. He stressed the important part that the shippers have to play in the reduction of claims.

New Classification of Railway Employees Ordered

Labor Board Divides Workers Into 148 Reporting Divisions and 500 Occupational Classes

NEW RULES for the classification of railway employees and for reports as to their number and compensation have recently been issued by the United States Railroad Labor Board and approved by the Interstate Commerce Commission. The revised classification becomes effective on July 1. Reports to the Interstate Commerce Commission and to the Labor Board will be made under this classification thereafter. The new rules and classification are contained in a volume entitled, "Rules for Reporting Information on Railroad Employees Together with a Classification and Index of Steam Railroad Occupations," issued to the carriers by the Labor Board.

The introductory statement in this volume describes very clearly the inadequacy of the present reporting plan, and after outlining the difficulties encountered by various wage commissions and arbitration boards in collecting data upon which to base their decisions, the statement says: "In deciding questions at issue, the Labor Board was seriously handicapped because of the absence of wage data relating to homogeneous groups of occupations and classified according to the special working conditions found in railway operation. It seemed evident that steps would have to be taken by the United States Railroad Labor Board to secure current and properly classified data if it were correctly to perform its functions according to the provisions of the law.

The classification used for reporting the number of employees and their compensation is based largely upon a plan submitted to the Interstate Commerce Commission by the Railroad Administration during federal control. This classification was not adopted but it was submitted by the Commission to representatives of the railroads and the employees.

Purpose of the Occupational Classification

In outlining the purposes and value of the occupational classification of railroad positions the Labor Board's statement says in part:

The purpose of the occupational classification of railroad positions is to furnish a basis for the collection of wage and other data on homogeneous classes of railroad positions, to establish as nearly as can be a uniform terminology to be used in describing similar occupations, and to describe classes of positions so that all railroads may have the same general understanding of the kinds of positions that are to be included in any class.

The occupational classification is *in no way and under no circumstances to be interpreted by the Board, by the Interstate Commerce Commission, by the railroads or by other interested parties, as setting up jurisdictional lines for occupations, or as limiting the kinds of work which employees may perform or the duties which they may assume. In preparing the occupational classification, the Board has not aimed to standardize for the railroads the occupational duties assigned to, or the kinds of work performed by their employees, and nothing in the classification nor in the report forms is to be construed in this light.* Its purpose is solely so to group positions that the wage and other data reported to the Interstate Commerce Commission and to the Board may be used for administrative and public purposes. It specifically provides against grouping together occupations of widely different duties and responsibilities, as well as rates of compensation. By adhering to the classification and the groupings provided for in the reporting forms, wage data will be more than indiscriminate totals and the averages computed therefrom will be valuable for administrative and public purposes.

Reference to the occupational classification in making the reports to the Interstate Commerce Commission and the Board will facilitate the placement of positions and uniform segregation of wage and other employment data. The value of uniformity and definiteness in classification is particularly clear in the analysis of data on railroad positions which are well defined. In obtaining data on wages and other employment conditions for such positions as those in the train and engine service, where the terminology and language used are fairly uniform on the different railroads, definite and comparable information can be furnished by the railroads and with the least possible danger of misunderstanding.

With respect to other services it is difficult, under present conditions, for the Board to make clear the exact information desired and for the carriers to furnish classified data suitable for analysis. Positions such as those in the clerical and office administrative service are good examples. There is no classification or uniform language at present in use as to clerical positions and there is little or no distinction between positions of varying importance and responsibility. It is therefore difficult to obtain comparable wage data and other information necessary to the Board in rendering decisions or in interpreting and applying such decisions by the interested parties. The use of standard nomenclature based on duties will also enable the Board to make comparisons with similar occupations outside of the railroad service and to detect inequalities between positions on the railroads and in outside organzations.

In order to simplify the reporting divisions and at the same time to secure reports suitable to the Interstate Commerce Commission and to the Board, the distinctive classes in the occupational classification have been re-grouped into 148 reporting divisions. The reporting divisions have been arranged according to established broad departmental lines and data relating to them, based as they are upon a comprehensive grouping of positions, will meet the general requirements of both the Commission and the Board, thereby reducing the amount of labor necessary in preparing any special reports which either body may deem necessary.

Description of the Occupational Classification

A description of the occupational classification follows:

The basis and general plan of the occupational classification conform to the recognized lines and the best practice which have been followed by industrial and governmental organizations in the development of employment classifications for their services, the entire plan being based upon the principle that duties and responsibilities must control in any orderly arrangement and classification of positions.

The occupational classification may be described as a functional grouping of positions, the aim being to set up unit classes which group together positions of essentially similar nature having due regard to the duties and responsibilities which they require or imply.

All railroad positions are separated into main divisions which, for convenience, are called *services*. These are the broadest divisions of positions and are determined irrespective of departmental lines. Such a grouping of services admits of a bird's-eye view of the entire range of railroad positions.

The services are sub-divided into *groups* of related positions covering work which is generally performed in the same profession, vocation or trade, or in a particular kind of railroad work.

Wherever there are wide and clearly discernible differences in the importance, difficulty and responsibility of the work performed, the groups are further sub-divided into *grades* which consist of one or more *distinctive classes* of positions. These classes are the smallest units provided for in the classification and are made up of positions carrying essentially similar duties and responsibilities. Each class is given a distinct title and described so far as is necessary to indicate the kinds of positions which fall under such distinctive class.

Under each of the respective services, groups and grades there is set out general descriptive statements of the duties and responsibilities of the services and groups and of the distinctive classes of positions. These descriptions are set out solely as distinguishing particular kinds of work, so as to provide for essentially homogenous classes of occupations.

The various positions found in the steam railroad service are grouped in the occupational classification under seventeen (17) major services; these services having been set up according to the general railroad functions as well as the special and peculiar requirements in railroad organizations. The services are sub-divided into 119 groups. Within the groups are the separate grades and distinctive class titles, each of which has a description of duties generally performed and illustrative examples.

Outside of the executive, official and staff assistant service, which is ungraded and unclassified and in which examples of posi-

tions are shown separately under appropriate groups but not distinguished as to importance and responsibilities of work performed, there are 500 distinctive classes which are distributed under the other sixteen (16) services as follows:

Service	Number of Distinctive Classes
Attendance service	26
Clerical and office administrative service	27
Dining car, restaurant and kitchen service	19
Engine and equipment operation service	31
Floating equipment service	62
Inspectional service	34
Investigational and instructional service	10
Labor service	50
Police service	6
Professional service	23
Skilled trades service	103
Sub-professional service	7
Supervisory skilled trades and labor service	43
Traffic service	10
Train and engine service	29
Train dispatching, telegraph and station agent service	20
Total number of distinctive classes	500

The occupational classification with the alphabetical finding list should be used as a basis in distributing occupations in the reports which are to be made to the Interstate Commerce Commission and to the Board. This does not mean that the railroads are required in making up the regular reports to the Interstate Commerce Commission and to the Board to observe all of the separate class distinctions provided for in the classification, but they are required to follow the definitions and make the distinctions which apply to the divisions of occupations upon which they report. It is hoped, however, that the classification in its detailed form will prove of such value to the railroads in viewing their employment problems as a whole that they will, of their own free will, install it as a basis for employment administration, and reap the advantages which would accrue therefrom.

The classes into which the railway employees have been divided for the purpose of reporting their number and compensation are as follows:

I—Executives, Officials and Staff Assistants

1 Executives, general officers and assistants.
2 Division officers, assistants and staff assistants.
Total (executives, officials and staff assistants).

II—Professional, Clerical and General

3 Architectural, chemical and engineering assistants (a).
4 Architectural, chemical and engineering assistants (b).
5 Sub-professional engineering and laboratory assistants.
6 Professional and sub-professional legal assistants.
7 Supervisory or chief clerks (major departments).
8 Chief clerks (minor departments) and assistant chief clerks and supervising cashiers.
9 Clerks and clerical specialists (a).
10 Clerks (b).
11 Clerks (c).
12 Mechanical device operators (office).
13 Stenographers and secretaries (a).
14 Stenographers and typists (b).
15 Storekeepers, sales agents and buyers.
16 Ticket agents and assistant ticket agents.
17 Traveling auditors or accountants.
18 Telephone switchboard operators and office assistants.
19 Messengers and office boys.
20 Elevator operators and other office attendants.
21 Lieutenants and sergeants of police.
22 Patrolmen.
23 Watchmen (without police authority).
24 Supervising traffic agents.
25 Traffic agents, advertising and development agents.
26 Fire prevention, smoke and time service inspectors and office building superintendents.
27 Claim agents and claim investigators.
28 Real estate and tax agents and investigators.
29 Examiners, instructors and special investigators.
30 Miscellaneous trades workers (other than plumbers).
31 Motor vehicle and motor car operators.
32 Teamsters and stablemen.
33 Janitors and cleaners.
Total (professional, clerical and general).

III—Maintenance of Way and Structures

34 Road masters and general foremen (M. of W. & S.).
35 Assistant general foremen (M. of W. & S.).
36 Supervising maintenance of way and scale inspectors.
37 Maintenance of way inspectors.
38 Bridge and building gang foremen (skilled labor, M. of W. & S.).
39 Bridge and building carpenters.
40 Bridge and building iron workers.
41 Bridge and building painters.
42 Masons, bricklayers, plasterers and plumbers.
43 Skilled trades helpers (M. of W. & S.).
44 Regular apprentices (M. of W. & S.).
45 Portable steam equipment operators (M. of W. & S.).
46 Portable steam equipment operator helpers (M. of W. & S.).
47 Pumping equipment operators (M. of W. & S.).
48 Gang foremen (extra gang and work train laborers).
49 Gang foremen (bridge and building, signal and telegraph laborers).

FORM "A"

Month of.....192... .....Railroad

Division number	Reporting division	Number of employees, middle of month	Number of full time positions	Service-hours (or days): Straight time actually worked	Overtime paid for at pro rata rates	Overtime paid for at punitive rates	Time paid for but not worked	Total time paid for	Compensation: Straight time paid for	Overtime paid for at pro rata rates	Overtime paid for at punitive rates	Time paid for but not worked	Total	Division number
1		2	3	4	5	6	7	8	9	10	11	12	13	

FORM "B"

Month of.....192... .....Railroad

Division number	Reporting division	Number of employees: Middle of month	On dates of month: 7	15	22	28	Service-hours: Straight time actually worked	Straight time paid for	Overtime paid for	Constructive allowances (see instructions)	Total	Compensation: Straight time actually worked	Straight time paid for	Overtime paid for	Constructive allowances	Total (see instructions)	Grand total	Miles: Actually run	Paid for but not run	Total number of trips for which not less than a minimum day was paid	Division number
1		2	3				4	5	6	7	8	9	10	11	12	13	14	15	16	17	

Forms for Reporting Information on Railroad Employees

88 Stationary firemen and oilers (steam and electrical plants).
89 Coal passers and water tenders (steam station boiler rooms).
Total (maintenance of equipment and stores).

V—Transportation (Other Than Train, Engine and Yard)

90 Chief train dispatchers, train dispatchers and train directors.
91 Station agents supervisory—major stations—non-telegraphers).
92 Station agents (supervisory—smaller stations—non-telegraphers).
93 Station agents (non-supervisory—smaller stations—non-telegraphers).
94 Station agents (telegraphers and telephoners).
95 Chief telegraphers and telephoners or wire chiefs.
96 Clerk—telegraphers and clerk—telephoners.
97 Telegraphers, telephoners and towermen.
98 Station masters and assistants.
99 Supervising baggage agents.
100 Baggage agents and assistants.
101 Baggage, parcel room and station attendants.
102 General foremen (freight stations, warehouses, grain elevators and docks).
103 Assistant general foremen (freight stations, warehouses, grain elevators and docks).
104 Gang foremen (freight station, warehouse, grain elevator and dock labor).
105 Callers, loaders, sealers and perishable freight inspectors.
106 Truckers and laborers, (stations, warehouses and platforms).
107 Laborers (coal and ore docks and grain elevators).
108 Common laborers (grain elevators).
109 Stewards, restaurant and lodging house managers and dining car supervisors.
110 Chefs and first cooks (dining cars and restaurants).
111 Second and third cooks (dining cars and restaurants).
112 Waiters and lodging house attendants.
113 Camp and crew cooks and kitchen helpers.
114 Barge, lighter and gasoline launch officers and workers.
115 Deck officers (ferry boats and towing vessels).
116 Engine room officers (ferry boats and towing vessels).
117 Deck and engine room workers (ferry boat and towing vessels).
118 Deck and engine room officers and workers (steamers).
119 Floating equipment shore workers and attendants.
120 Transportation and dining service inspectors.
121 Parlor and sleeping car conductors.
122 Train attendants.
123 Bridge operators and helpers.
124 Crossing and bridge flagmen and gatemen.
125 Foremen (laundry) and laundry workers.
Total (transportation—other than train and engine).

VI-a—Transportation—(Yard Masters, Switch Tenders and Hostlers)

126 Yard masters and assistants.
127 Switch tenders.
128 Outside hostlers.
129 Inside hostlers.
130 Outside hostler helpers.
Total transportation—(yard masters, switch tenders and hostlers).

VI-b—Transportation—(Train and Engine Service)

131 Road passenger conductors.
132 Assistant road passenger conductors and ticket collectors.
133 Road freight conductors (through freight).
134 Road freight conductors (local and way freight).
135 Road passenger baggagemen.
136 Road passenger brakemen and flagmen.
137 Road freight brakemen and flagmen (through freight).
138 Road freight brakemen and flagmen (local and way freight).
139 Yard conductors and yard foremen.
140 Yard brakemen and yard helpers.
141 Road passenger engineers and motormen.
142 Road freight engineers and motormen (through freight).
143 Road freight engineers and motormen (local and way freight).
144 Yard engineers and motormen.
145 Road passenger firemen and helpers.
146 Road freight firemen and helpers (through freight).
147 Road freight firemen and helpers (local and way freight).
148 Yard firemen and helpers.
Total (transportation—train and engine).

The forms on which data regarding these various classes of railway employees are to be reported to the Interstate Commerce Commission and to the Labor Board are shown in the accompanying illustrations.

Form A is to be used for the following groups:

1. Executives, officials and staff assistants.
2. Professional, clerical and general.
3. Maintenance of way and structures.
4. Maintenance of equipment and stores.
5. Transportation (other than train, engine and yard).
6. (a) Transportation (yardmasters, switch tenders and hostlers).

Form B is to be used for reports regarding employees in group 6b—Transportation (train and engine service).

Safety Matches often prove inconvenient to anyone using them, because of their fragile character, being too short and easily extinguished; and the Railway Fire Protection Association has received complaints from trainmen and lampmen that they have trouble with such matches in lighting lanterns and switch lights. The president of the association has conferred with other superintendents and has found no complaint; but, at all events, he holds that none but approved safety matches should be used on railroads.

Hearing on Pennsylvania Locomotive Repairs

Washington, D. C.

Oral arguments before the Interstate Commerce Commission at Washington on June 20, on the question whether the Pennsylvania caused 200 of its locomotives to be repaired at the shops of the Baldwin Locomotive Works in 1920 in disregard of efficient and economical management, resulted in a complicated statistical controversy as to whether the Pennsylvania showed wise management in making this contract instead of repairing the locomotives at its own shops. However, it remained for members of the commission to bring out by questions why so little had been put into the record at the previous hearings before an examiner bearing on the charges made by the International Association of Machinists that the repair contract was made for ulterior purposes to transfer money from the Pennsylvania Railroad, to be collected from the United States Government in the form of a guaranty, and into the treasury of an outside company for the profit of the banking combine said to control the railroads. The commissioners' questions on this point merely brought out that it was simpler to make such charges than it was to attempt to prove them and the commission was left to assume the evidence of a gigantic conspiracy which has been used so extensively as publicity material.

In reply to questions by Commissioner Lewis, R. B. Gregg, who appeared as attorney for the machinists' union, said that his organization would have objected to the contract even if the Pennsylvania had paid no more than the cost in its own shops, on the ground that it caused unemployment among the railroad shop men, although it had developed that the laying off of large numbers of Pennsylvania shop men had not taken place until several months after the letting of the contract and after business had begun to fall off in the latter part of the year.

Attorney List, who had represented the commission in the hearings and investigation, devoted himself largely to arguing that the Pennsylvania had paid $3,173,000 or over $16,000 per locomotive more than it would have cost to do the same work in its own shops, and that there was no justification for placing the outside contract because he argued that the Pennsylvania had sufficient shop capacity to handle the work itself, and its locomotive condition was better than it had been the year before. He went into a detailed analysis of the Pennsylvania shop statistics to prove his point and asserted that after the making of the contract with the Baldwin Company the Pennsylvania had laid off 10,000 men from its locomotive repair forces. He said that J. T. Wallis, superintendent of motive power of the Pennsylvania, had previously reported to the Railroad Administration, shortly before the termination of federal control, that it was unnecessary to send any of the Pennsylvania locomotives to shops of other railroads for repairs, yet the contract was entered into shortly after the road was returned and some of the engines were sent to Baldwin before the contract had been approved by the Pennsylvania directors. He also disputed some of the testimony of the Pennsylvania witnesses until Commissioner Potter asked him whether he had taken a partisan attitude in conducting the investigation. Mr. List insisted that he had not done so, but admitted that perhaps his experience of 12 or 14 years in the work of prosecution for the commission had led him to adopt a similar attitude in dealing with "somewhat evasive witnesses."

Necessary to Meet Demands of Shippers

Henry Wolfe Bikle, counsel for the Pennsylvania, admitted that the comparison of costs used was fairly accurate, but defended the action of sending the locomotives to an outside

shop for repairs on the ground that it was absolutely necessary to prepare the locomotives to meet the demands of the shippers for service and that while the cost was large, each locomotive that was put in condition for service was able to earn much more than the cost. Therefore the contract, he said, was not extravagance, but resulted in a real economy. He said the list of shop employees laid off had been put into the record at the request of attorneys for the machinists' union and had been given in complete detail, but had not thereafter been used, and he read from the statement to show that while a few hundred men engaged in running repair work had been laid off during July, August, September and October, 1920, these were not men engaged in making classified repairs, while most of the 10,000 men were laid off in November, December and January. In January, 5,300 men were laid off. Mr. Bikle said the commission would recall that in 1920 the shippers were demanding better service and were even asking the commission to increase freight rates to help the roads give better service and that the company was not able even with the assistance given by the Baldwin company in repairing these locomotives to meet all of the demands for service. He also pointed out that the six months' guaranty provided by the Transportation Act did not provide any immediate cash payment to the railroads and that under its provisions all expenditures of the railroad for maintenance were subject to the scrutiny of the commission, so that the guaranty did not place the burden of any extravagant expenditures upon the government.

He discussed in detail the testimony that had been given at the hearings to show that the Pennsylvania had operated its shops to capacity throughout the entire period that the 200 locomotives were being repaired at the Baldwin plant and that the classified locomotive repair work done at the company's shops in 1920 actually exceeded that done in any previous year. Regarding Mr. Wallis' report to the Railroad Administration, he said that this was made during the latter part of the period of federal control at a time when the Railroad Administration would hardly have had the authority to require the repairs to be made in the shops of other roads when most of the work would have been done at the expense of the corporation. When the roads were returned, he said, the Pennsylvania officers foresaw the heavy traffic that was confronting them at a time when 18 per cent of the Pennsylvania locomotives were in shop or awaiting shop. That was an alarming situation and something had to be done quickly. He pointed out that the comparisons used in criticism of the contract were largely based on 1919 figures for a period when traffic was much lighter than that of 1920 and it was necessary to do a greater amount of shop work to perform locomotive service.

Contends Pennsylvania Had Plenty of Shop Capacity

R. B. Gregg, representing the machinists' union, argued that the Pennsylvania had plenty of shop capacity for taking care of all of its own repairs, that it had adequate equipment and an adequate force and that there was nothing in the National Agreement to prevent the operation of the shops for longer hours, although the railroad would have had to pay punitive overtime. In reply to a question by Commissioner Potter as to a statement reflecting on the efficiency of the Pennsylvania management during federal control, Mr. Gregg said his theory was that the management deliberately held down production by delaying the men and withholding material and tools. Commissioner McChord asked why the evidence on that had not been put into the record. Mr. Gregg said that his information was received from employees and he was unwilling to run the risk of having them discharged. Commissioner McChord thought it strange that he had been unable to get one man out of 48,000 to testify and rely on the commission to see that no one was discharged for testifying.

Commissioners Ask Some Leading Questions

Mr. Gregg argued that, looking back over the statistical records, it was proved not only that the Pennsylvania could have repaired the 200 locomotives in its own shops in the time that was taken for the work at the Baldwin shops, but that the management should have reasonably anticipated its ability to do so. Commissioner Potter asked if it had been shown that Baldwin made a greater profit on this work than on its other work. Mr. Gregg said there was no information as to the profits on this work. Mr. Potter said that if Mr. Gregg's argument had force it left as the only reason for the action of the Pennsylvania the "conspiracy" regarding which charges had been made and which had been mentioned in Mr. Gregg's brief, but as to which no evidence had been presented. Mr. Gregg said the examiner had excluded evidence as to the entire profits made by the Baldwin Company and that the evidence was limited to the Pennsylvania transaction, whereas the conspiracy was on the part of the groups of bankers in control of the railroads and the equipment companies and was difficult to prove. Mr. Potter asked if the commission was expected to assume the conspiracy. Mr. Gregg said he thought in this case it could. Mr. Potter said that all the evidence went to the question of whether the Pennsylvania had made an improvident contract and gave no light on the question of the ulterior motive. He asked if the Baldwin plant was not very busy at the time and what object it had in taking the Pennsylvania contract unless it got a "fancy" price for it. Mr. Gregg said he did not know how much of the Baldwin work was construction and how much was repair work. Mr. Gregg asserted that men in control of the bankers and the railroads believed it was easier to make money through the equipment companies than through the railroads and that the Pennsylvania management had been particularly hostile to organized labor and that part of the conspiracy was for the purpose of causing unemployment among the railroad shop crafts. Mr. Potter said that nothing had been proven about any ulterior motive or any undue profit to the Baldwin Company. Commissioner McChord then inquired why the evidence regarding the Baldwin profits had been excluded and Attorney List said that the examiner had taken the position that the Baldwin Company was not under investigation. He added that the Baldwin Company had lost money on the first part of its contract, but had later made it up and that if the claim of the Pennsylvania that an emergency existed was true, it made no difference what the Baldwin profit was. Commissioner McChord expressed surprise that this fact had not been shown in the record. Commissioner Potter than asked what witnesses had been presented by the intervenor, the machinists' union, and was told that Mr. Gregg had presented some testimony, but had called Mr. Rea as his witness.

"The company was confronted in March, 1920," Mr. Bikle said, "with a situation of serious moment, serious not only to it, but to the shippers located along its line. It had the choice of pursuing a policy which would have impaired the service which it could furnish the public and which would have reduced its revenues, but which, on the other hand, would have avoided the possibility of unwarranted criticism on the score of supposed unnecessary expenditures. It chose the course which insured, so far as it could, its ability to meet the demands which it foresaw would be made upon it. If, in the making of this choice, there can be found ground for criticism, it is difficult to perceive what decision of managerial policy cannot also be criticised, particularly when it is remembered that the basis of the criticism is that the situation could have been met without adopting the course pursued. In some instances, this perhaps might be regarded a matter of doubt, but in the present instance, considering the actual developments during 1920, after the decision was made, there is, it is submitted, no possible ground on which it can be justly said that the decision was other than a vise one.

Pullman Fare Hearing

WASHINGTON, D. C.

A HEARING on the complaint of the United Order of Commercial Travelers and other similar organizations attacking as unreasonable the increase of 20 per cent in Pullman fares which was made on May 1, 1920, was held before Chief Examiner Quirk of the Interstate Commerce Commission at Washington on June 16. Two hearings in the case were held last fall after which the case was adjourned at the suggestion of the complainants until the figures for a year's operations under the new rates should be available.

J. A. Millener, attorney for the complainants, confined his case at the hearing almost entirely to the reduction in price of half a dozen articles used by the Pullman Company, although he also attempted to make a point of the money the Pullman Company is claiming from the Railroad Administration and of the expected reduction of wages on July 1.

Mr. Millener called as his first witness L. S. Taylor, vice-president of the Pullman Company, and brought out from him that the price of car wheels, which was $59 in 1920, has now been reduced to $58; oil boxes from $13.75 to $10; brake shoes from $73 a ton to $66; plush $5.22½ a yard, has not changed in price; berth curtain material has been reduced from $5.97 a yard to $2.60; and axles from $4.32 per 100 lb. to $3.95. Having gained this information, he stopped, but G. S. Fernald, counsel for the Pullman Company, asked the witness regarding the quantities of those materials used and Mr. Taylor said the company uses approximately 20,000 wheels, so that the saving on that item is $20,000; about 16,000 oil boxes, so that the saving is $60,000; about 8,000 tons of brake shoes, on which the saving is $56,000; 90,000 yards of plush, on which there is no reduction; while very little curtain material is now being used because the company is building no new cars.

Mr. Millener then asked if the company had not reduced the wages of the employees in its shops. Mr. Taylor said that a reduction of about 9 per cent on the average had been made on January 1 in the shop of the manufacturing department at Pullman, Ill., which manufactures cars to sell, but is not now building any new Pullman cars and which does no repair work for the Pullman Company except when cars are sent to it to be rebuilt, the ordinary repair work being done at five other shops and in various yards throughout the country in which the wages have not been reduced. Mr. Fernald objected to the introduction of evidence regarding the manufacturing plant on the ground that its costs are not involved in the operating expenses of the car lines, and Examiner Quirk ruled that the questions must be confined to those bearing on the operating accounts. Mr. Millener insisted that the manufacturing plant was part of the company, but Mr. Quirk said that the commission's jurisdiction is confined to the operations of the company as a carrier. Mr. Taylor was asked to file a statement showing the amount of the reduction in wages for a year, but said this would be impracticable because the operations are decreasing all the time and by July 1 the plant will be practically out of orders. He agreed to file a statement showing the difference in the labor cost per car in the first six months of 1921 as compared with the last six months of 1920, which he said would be very slight. There has been no reduction in the cost of repairs, he said. On the other hand, there has been a material increase since last spring because of the award of the Railroad Labor Board last July, retroactive to May 1. The principal material used, steel, has been reduced very little in price.

Mr. Taylor was asked if the Labor Board had not made a ruling which gives the company the right to contract with its employees as to wages after July 1.

"Not to our knowledge," he replied. This led to a discussion regarding the peculiar status of the company before the Labor Board. Mr. Fernald explained that the Pullman Company was not a party to the decision of the Board which promised a 12 per cent reduction in wages on July 1 and while it has since asked to be made a party, the labor organizations have protested that the company is not properly before the Board and that matter is for the Board to decide. Mr. Taylor said the company hoped to be able to follow the railroads and reduce wages on July 1, but was not yet certain of the result and the reduction would "only be a drop in the bucket," anyway.

Attorney Millener also asked about the company's claim against the Railroad Administration, saying he understood the company was claiming $9,000 a car for repairs and that the company had expected to get $2,000,000 from the government. Mr. Taylor said the company's total claim against the Railroad Administration was $24,500,000, of which about $7,250,000 is for undermaintenance, and the administration has paid $7,000,000 on account. He said the claim for undermaintenance was based on an inspection of the equipment, which had been allowed to run down during the period of federal control, made jointly by the representatives of the company and of the administration, and the company had claimed from $6,500 to $7,000 each for a number of standard cars, stripped at the order of the director general, used for troop service, and then converted back. The claim also covered loss of supplies and other items. Mr. Taylor also described the damage to the cars done by the soldiers, but later asked that those remarks be kept out of the record. The company has been informed that the Railroad Administration will be prepared to begin negotiations for settlement about September 1. Mr. Millener asked if the claim would not cover the high cost of repairs in 1920 and 1921. Mr. Taylor said that it was confined to the period of federal control, whereas the company had spent $21,000,000 for maintenance in 1920 and had overhauled only one-third of the cars. Asked how the $7,000,000 would be used, Mr. Taylor said that it had been spent for wages and materials and had reduced by that much the company's deficit. He said there is very little chance of the company's getting the full amount of its claim because the railroads that have settled thus far have received less than 50 cents on the dollar. The attorneys for the commercial travelers asked questions assuming that the company would collect the full $24,000,000, but the examiner ruled that they must confine their questions to the $7,000,000 already collected and ruled out questions regarding "the money the company may never get." In reply to questions as to who had stripped the cars, Mr. Taylor said that he had done so as federal manager of the Pullman Car Lines at the order of the director general, although some cars had been stripped before at the request of the War Department.

Mr. Millener's witnesses were two assistant buyers of a large department store in Washington, who testified as to the reduction in prices of materials similar to those used by the Pullman Company, although in each case Mr. Taylor pointed out that the articles to which the prices were applied were not the same as those used by the Pullman Company, which were specially manufactured for it and of the best quality obtainable. It was testified that the present price of carpet similar to that used by the Pullman Company is $4.50 per yard with a 10 per cent reduction for large quantities, as compared with $5.75 last fall, and that the company uses 90,000 yards of carpet yearly. Mr. Taylor said the company is now paying $4.35 a yard for a better grade of carpet than that described. A price of $8.70 for blankets as compared with $11 last year was quoted. Mr. Taylor says the company is now paying $7.55 for blankets. Figures were also given for sheets, but of a smaller size than those used by the company. When one of the witnesses quoted a price of $1.50 a dozen for hand towels similar to those used by

the company, Mr. Taylor asked if the witness' company would take a large order at that price for Pullman towels. Mr. Taylor said the company pays $2.15 a dozen for towels specially woven with a blue stripe and the name of the company and the date. The witness said he had been making only a general comparison of the towels from observation. The witness also said that pillow-slips had been reduced from $3.75 a dozen to $3.00 or $3.25. Mr. Taylor said that there had been a greater reduction in blankets and sheets than in any other articles.

Mr. Taylor's testimony on behalf of the company was confined to the introduction of a series of exhibits giving the revenues, expenses, payroll and costs of materials and supplies of the company, with quantities, for the past year as compared with previous periods. He said the average compensation of the employees had been increased during the year from $1,406 a year to $1,484. The car earnings, Mr. Taylor said, had been steadily decreasing since the application of the 50 per cent surcharge until in April, 1921, the revenues were $458,000, or 7.53 per cent less than in April, 1920, and the number of berth and seat passengers was 24 per cent less. There was an increase in the revenues from May 1, 1920, to August, representing approximately the 20 per cent increase in fares, but after the surcharge was applied there was a steady decline both in the number of passengers carried and in the revenue until, in February, the gain in revenue derived from the increase in fares was entirely wiped out.

"We do not claim," he said, "that this was due entirely to the surcharge, but the application of the surcharge was a serious blow to the Pullman Company's revenues and it is a serious question whether the railroads have gained by it. Our thought is that they have lost in passenger revenues."

The opposing sides were allowed until August 15 to file briefs in the case.

Freight Rates Must Be Readjusted; Not Horizontally Reduced*

By Francis H. Sisson

Vice-President of the Guaranty Trust Co., New York

FOLLOWING THE RECENT DECISION reducing wages of railroad employees on about 100 roads, there has been considerable agitation for an immediate horizontal reduction in freight and passenger rates. Such a reduction would be extremely advantageous, of course, if it were possible without further jeopardizing the finances and credit of the carriers. The wage revisions are expected to "add" $700,000,000 to railway net income. But even that will not enable the roads to earn a net return of 5½ or 6 per cent as contemplated in the Esch-Cummins Law. Certainly, it will not justify a horizontal rate reduction now.

During the war, horizontal rate increases were made, but now, with many commodity prices dropping sharply, the problem is to bring about a rate readjustment by which lower rates will be provided for commodities that cannot be handled at the present rate levels, and not to effect a horizontal rate reduction which will take away from the railroads all that they hope to save through the forthcoming wage economies.

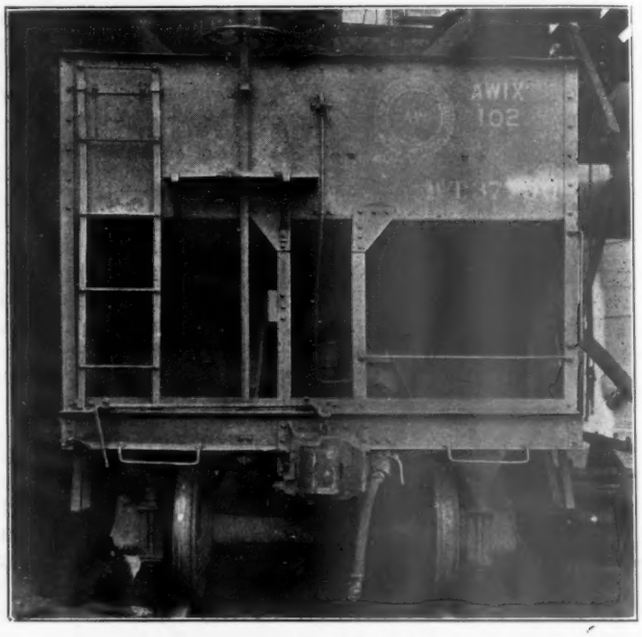
Approximately 50,000,000 Americans are the indirect owners of our railroads through the investment of their savings in railroad securities, and they should be keenly interested in the welfare of the railroads.

They should realize that railroad operating costs must be cut down before there can be justifiable general reductions in railroad rates.

*Extract from an address before the American Institute of Banking at Minneapolis, Minn., on June 16.

Safety Hand Brake

A NEW DESIGN of safety hand brake, made by the Minich Railway Appliance Corporation, Philadelphia, Pa., has been tested recently under severe service conditions and reported on favorably by the Interstate Commerce Commission. The brake consists of a vertical shaft, similar to those in common use, and attached as usual to the end of the car. The bottom of the shaft, however, is supported by a special cage casting, and is threaded to take a nut which is guided by slots in the cage. The nut moves vertically up and down, depending on which way the staff is revolved. On opposite sides of the nut are lugs forming trunnions by which a U-shaped lever is operated. The usual brake chain, or air brake lever in the case of hopper cars is replaced by a connecting rod. Round lugs on opposite sides of the cage serve as a fulcrum for the U-lever so that when the staff is revolved and the nut raised, the lever revolves on these lugs and tends to change from an approximately horizontal to a vertical position, thus pulling up and applying the brakes through the rigging in common use. The fulcrum of the U-lever changes so that the power is comparatively low at the beginning, permitting the slack to be taken up quickly, but resulting in an increase of leverage, and power towards the end of the application. No pawl is necessary to hold the brakes applied, since they can be released only by turning the staff in the opposite direction.



Hopper Car Equipped with Minich Safety Hand Brake

It is maintained that this brake is an important safety device, being more efficient, inexpensive and easier to operate than the familiar ratchet and pawl type. The brake holds where applied and is not released partly to allow a pawl to engage, consequently all the energy is maintained and not lost when most needed. The brake is said to be three times as powerful as an ordinary brake and this without the use of a brake stick. Ratchet, pawl and brake chain are eliminated. It is stated that cars can be controlled accurately and easily on down grades, accidents being prevented by eliminating danger of sudden releases. All stress on the staff is vertical, therefore the parts will not be frequently bent and forced out of alinement. Owing to the use of few parts and a short, light staff, there is a saving in material and time required to install the brake.

General News Department

A. R. A. Mechanical Division Meeting Postponed Indefinitely

The postponed meeting of the Mechanical Division, American Railway Association, which was to have been held at the Blackstone Hotel, Chicago, on Wednesday and Thursday, June 29 and 30, has again been postponed as announced in a circular issued by the Mechanical Division on June 21. In view of the uncertainty as to conditions for the next few weeks no date has been set for the postponed meeting.

A fire at the roundhouse of the Boston & Maine, Portsmouth, N. H., on June 20, damaged the building and several locomotives at a total estimated loss of $150,000.

Five persons were killed and 16 injured in a rear collision of interurban cars on the Detroit United Railway near Ann Arbor, Mich., on June 18. A wooden car was telescoped by a steel car.

The Interstate Commerce Commission has announced a hearing at Washington on June 29, before the commission, on the final value of the San Pedro, Los Angeles & Salt Lake and the Kansas City Southern.

J. M. R. Fairbairn, chief engineer of the Canadian Pacific and also president of the Engineering Institute of Canada, was given the degree of Doctor of Science by the University of Toronto, at Toronto, Canada, on June 9.

E. H. Morton, president of the Order of Railway Station Agents, has filed a petition with the Interstate Commerce Commission asking it to reopen its regulations regarding the designation of subordinate officers and to classify station agents as subordinate officers.

The Mechanical Division of the American Railway Association has isued a supplement to the 1920 Rules of Interchange, prepared by the Arbitration Committee. This supplement includes corrections to the rules, several additional interpretations rendered by the committee, and a few changes which have been made to clarify the rules.

Passenger trains on the Pennsylvania Railroad System in the month of May, this year, showed a marked improvement; 95.7 per cent of the trains arrived at destination on time, and 97.6 per cent made schedule time. In the three months ending with May the percentage making schedule time was over 97 per cent, as compared with 90 per cent in 1920.

Four strikers from the Missouri & North Arkansas, were convicted in the United States District Court and given jail sentences at Little Rock, Ark., on June 17. The strikers were sentenced on charges of contempt of court growing out of their interference with employees of the road, which is operating under a federal receivership. The offense, which consisted of abusing trainmen, was committed on June 2 and the sentences ranged from 90 days to 30 days each.

Freight Must Be Prepaid on B A R

The Bangor & Aroostook has given notice that on freight shipped from stations on its line to points on or beyond the Maine Central the freight charges, for transportation over the Bangor & Aroostook, must be prepaid.

President P. R. Todd is quoted as saying that this action is necessary to provide money to meet payrolls and other pressing bills.

Honorary Degrees

At the commencement exercises at Williams College, Williamstown, Mass., on June 20, the honorary degree of doctor of laws was conferred on Edgar E. Clark, chairman of the Interstate Commerce Commission.

At the commencement exercises at Tufts College, Medford, Mass., on June 20, the honorary degree of master of arts was conferred on Samuel O. Dunn, editor of the *Railway Age*.

Mechanical Division Scholarships

Three vacancies occur in June, 1921, in the scholarships awarded to sons of railroad men or others with experience in the mechanical department and administered through the Mechanical Division of the American Railway Association. Two of the vacancies are in the scholarships at Stevens' Institute of Technology and the third is one of Joseph T. Ryerson & Son's scholarships which provides for a four-year course at universities elected by the American Railway Association. Application for these scholarships can be made through V. R. Hawthorne, secretary of the Mechanical Division, Chicago.

Eight Killed in Collision of Fire Truck and Locomotive

At a crossing in Perth Amboy, N. J., on the afternoon of June 15, a fire truck dashed at full speed into the side of a passenger train of the Central of New Jersey, which was passing over the crossing at about 40 miles an hour. The truck was wrecked; eight firemen and a gate tender were killed and several other firemen were injured. The gates had not been closed. A number of automobiles had stopped just short of the crossing and it is conjectured that the driver of the fire truck assumed that these automobiles had been stopped in order to clear the road for him.

Complaints Under Pennsylvania Train-Crew Law

Trainmen of all classes, acting through the lodges of their brotherhoods, have filed with the Public Service Commission of Pennsylvania complaints alleging that numerous trains are undermanned, and asking that the commission exercise its authority to prescribe the number of men in the crews, the railroads having reduced them since the repeal of the full-crew law. These complaints were filed against the Delaware & Hudson, the Delaware, Lackawanna & Western, and the Pennsylvania, the last named being based on charges connected with the operation of certain trains on the Monongahela division. The complaint against the Delaware & Hudson says that the practice of that company is now at variance with the rules prescribed in the company's code of train rules.

Pennsylvania Relief Department

G. L. Peck, vice-president of the Pennsylvania Railroad System, announces that in response to requests from employees the Voluntary Relief Department will receive subscriptions to additional death benefits up to three times the amount of the death benefit of the class in which the employee holds membership at present. Heretofore the amount of death benefits to which a member could subscribe varied from $250 to $1,250; now it will be from $1,000 to $5,000.

The Voluntary Relief Department at present numbers about 190,000 members. It was instituted on February 15, 1886. Employees becoming members of the Relief Fund are divided into five classes, each of which carries a certain amount of death benefit in multiples of $250. It is the amount of these death benefits which has now been raised. Since the Relief Department was established in 1889, total subscriptions by employees amount to

more than $80,500,000 and total disbursements to more than $73,800,000. The companies comprising the Pennsylvania System have contributed more than $10,000,000 as the operating expenses of the fund.

Bridge Disaster at Whitney, Neb.

Five passengers and one trainman were killed and six passengers were seriously and 25 slightly injured, when eastbound passenger train No. 606 on the Chicago & North Western, went through a bridge over Big Cottonwood Creek, near Whitney, Neb., on the night of June 15. The bridge, which had been weakened by erosion caused by flood water, gave way just after the engine of the train had passed over it; and the mail and baggage cars and two coaches piled up on the bank of the creek and in the stream. One Pullman car and the superintendent's car, which was attached to the train, were left standing on the track. The engine, after breaking away from the train, ran some 600 ft. Two of the trainmen, the express messenger and the fireman were slightly injured

Traffic Statistics for March

The net ton miles of revenue freight handled by the Class I railroads in March aggregated 23,962,000,000, as compared with 32,910,000,000 in March, 1920, according to the monthly bulletin of traffic statistics issued by the Interstate Commerce Commission. The number of passenger miles for the month was 3,056,000,000, as compared with 3,533,000,000. The average revenue per ton mile for the month was higher than it has been at any month since the increased rates were made effective, 1.335 cents, as compared with 0.986 cents in March, 1920. For the three months ending with March the revenue per ton mile averaged 1.269 cents. The revenue per passenger mile for March was 3.175 cents, as compared with 2.613 cents in March, 1920, and 3.127 cents for the first three months of 1921. The average number of revenue passengers per car for the first three months of 1921 was 16.66, as compared with 18.68 in 1920.

E. E. Clark Re-elected Chairman of the Interstate Commerce Commission

The Interstate Commerce Commission on June 18 announced that Chairman E. E. Clark has been unanimously re-elected chairman of the commission for the year terminating June 30, 1922. For many years the commission followed the policy of rotating the chairmanship each year. Last year it was Commissioner Woolley's turn to be chairman and he was elected, but he declined the office on the ground that he had publicly opposed the passage of the Transportation Act which the commission was to administer. Commissioner Eastman was then elected and similarly declined the office, whereupon Commissioner Clark was elected for the term ending June 30, 1921, as senior member of the commission. Mr. Clark was appointed a member of the Interstate Commerce Commission by President Roosevelt in 1906.

Who Is to Blame for Freight Losses and Damage?

O. C. Castle, superintendent of transportation of the Southern Pacific (Texas and Louisiana lines), is the author of an effective bulletin prepared for use in interesting employees in the special claim prevention campaign which the company has launched. The bulletin is illustrated with a picture showing a section of the unclaimed warehouse, and the articles to be seen in the foreground of the photograph are described in the printed matter which follows, as examples of the results of careless handling, avoidable delays, or errors in marking.

In emphasizing the point that claim prevention can be successful only through the co-operation of the employees, the bulletin says in part: "The real preventive work must be done by the man who handles the goods. You, Mr. Agent, with your bill clerk, your check clerk and your warehouseman; you, Mr. Local Conductor, with your brakemen—you are the men on the firing line—you handle the individual packages that go wrong and find their way to the pile you see in the picture. Why not treat them as though they were addressed to you, or as though the loss would come out of your pocket?"

Railway Revenues and Expenses for April

The Interstate Commerce Commission's summary of railway returns for April and four months for 201 Class L roads, is as follows:

Item No.	Item	April 1921	April 1920	Four months 1921	Four months 1920
1	Average number of miles operated	235,570.45	234,785.09	235,578.09	234,538.55
	Revenues:				
2	Freight	$304,730,452	$268,812,703	$1,234,383,735	$1,204,271,218
3	Passenger	[1]90,698,125	92,963,857	[2]381,809,386	360,078,084
4	Mail	7,782,447	7,566,673	33,597,409	85,454,799
5	Express	8,221,064	11,823,542	27,104,263	49,114,965
6	All other transportation	12,323,996	9,804,227	50,533,242	43,426,611
7	Incidental	9,129,188	10,915,720	39,456,109	43,982,354
8	Joint facility—Cr.	656,581	556,473	2,629,809	2,338,167
9	Joint facility—Dr.	184,654	161,282	777,855	755,329
10	Railway operating revenues	433,357,199	402,281,913	1,768,736,098	1,787,910,869
	Expenses:				
11	Maintenance of way and structures	59,936,374	74,511,616	236,432,439	264,440,092
12	Maintenance of equipment	101,426,224	111,046,136	441,580,609	464,633,924
13	Traffic	7,114,392	5,069,762	28,843,864	20,045,887
14	Transportation	188,912,346	192,500,729	823,300,139	836,300,559
15	Miscellaneous operations	4,056,923	4,601,347	16,737,901	17,866,264
16	General	14,895,321	12,860,609	59,151,636	59,820,064
17	Transportation for investment—Cr.	642,594	170,737	2,090,359	1,053,486
18	Railway operating expenses	375,698,986	400,419,462	1,603,956,229	1,653,053,304
19	Net revenue from railway operations	57,658,213	1,862,451	164,779,869	134,857,565
20	Railway tax accruals	22,390,587	21,772,465	90,482,082	85,353,510
21	Uncollectible railway revenues	90,539	58,579	322,792	357,240
22	Railway operating income	35,177,087	19,968,593	73,974,995	49,146,815
23	Equipment rents—Dr. balance	4,432,558	2,222,638	15,263,640	10,097,606
24	Joint facility rent—Dr. balance	1,495,655	1,552,435	6,057,862	6,298,078
25	Net of items 22, 23 and 24	29,248,874	23,743,666	52,653,493	32,751,131
26	Ratio of expenses to revenues (per cent)	86.69	99.54	90.68	92.46

[1]Includes $2,735,279, sleeping and parlor car surcharge.
[2]Includes $10,334,326, sleeping and parlor car surcharge.

Plans to Expedite Settlement of Government Accounts

President Harding and the administration recently have been devoting consideration to the possibility of affording relief to the railroads through some way of expediting the settlements of their accounts with the government so that the roads may receive large sums still due them for the period of federal control, as well as for the six months' guaranty period of 1920. While there have been reports that the President was likely to exercise the discretion conferred upon him by the transportation act and authorize the Railroad Administration to increase the payments it may make on sums due the railroads by funding for a period of years the amounts owed by the railroads to the government for capital expenditures made during the federal control period, it is now understood that the President has been advised that this would involve another large appropriation of about $800,000,000 for the Railroad Administration to enable it to make the payments to the railroads. The director general recently made an estimate for the House appropriations committee that a $200,000,000 appropriation would carry him through another year on the assumption that he would not be requried to fund any large part of the railroads' indebtedness. In view of the desire to reduce government expenditures and taxation, the administration does not take readily to the idea of asking a large appropriation from Congress, but it is regarded as possible that the consideration of the subject may result in some plan for expediting the settlements of the accounts, including those for undermaintenance. The Railroad Administration in the settlements it has been

making with railroads has in general been deducting the additions and betterments from the amounts it owed the railroads, although in one or two cases some of the capital expenditures have been funded and the equipment has all been funded. The settlement of the Southern Railway is reported in the Financial department.

Automatic Train Control

The Joint Committee on Automatic Train Control of the American Railway Association co-operating with the Bureau of Safety of the Interstate Commerce Commission has been making material progress in connection with the development of automatic train control. Negotiations are being conducted with various railroads looking to the installation of automatic train control on test sections. Arrangements have been made with the Southern Pacific for an installation of the National Safety Appliance Company's intermittent induction type of train control from Oakland, Cal., to Niles, a distance of 22 miles. A proposed installation of the Sprague system is contemplated on a section of the New York Central, the location of which has not yet been definitely decided but will probably be near Albany, N. Y. This system is also of the intermittent non-contact induction type. Plans have been made for the installation of the continuous non-contact induction system as developed by the Union Switch & Signal Company on a short stretch of the Pittsburgh & Lake Erie near Pittsburgh; while a contemplated installation of the General Railway Signal Company's intermittent non-contact inert roadside element type is planned on the Buffalo, Rochester & Pittsburgh.

Advance List of Exhibitors at Roadmasters' Convention

The plans for the exhibit to be given by the Track Supply Association in connection with the convention of the Roadmasters' and Maintenance of Way Association at the Auditorium Hotel, Chicago, on September 20-22, inclusive, are well under way as evidenced by the fact that 45 firms have already requested and been assigned space at this exhibit. As in previous years this exhibit will be held on the ninth floor of the hotel in a room adjoining the convention hall. A list of manufacturers who have already been assigned space is given below.

Air Reduction Sales Company, New York City.
American Chain Company, Bridgeport, Conn.
American Hoist & Derrick Company, St. Paul, Minn.
American Steel & Wire Company, Chicago.
American Valve & Meter Company, Cincinnati, Ohio.
Anchor Company, New York City.
Balkwill Manganese Crossing Company, Cleveland, Ohio.
Bucyrus Company, South Milwaukee, Wis.
Carbic Manufacturing Company, Duluth, Minn.
Chicago Malleable Casting Co., Chicago.
Crerar, Adams & Co., Chicago.
Duff Manufacturing Company, Pittsburgh, Pa.
Elliot Frog & Switch Company, East St. Louis, Ill.
Fairbanks, Morse & Co., Chicago.
Fairmont Gas Engine & Railway Motor Car Company, Fairmont, Minn.
Hauck Manufacturing Company, New York City.
Hayes Track Appliance Company, Richmond, Ind.
Ingersoll-Rand Company, New York City.
Kalamazoo Railway Supply Company, Kalamazoo, Mich.
Kilbourne & Jacobs Manufacturing Company, Columbus, Ohio.
Lundie Engineering Corporation, New York City.
Maintenance Equipment Company, Chicago.
Mudge & Co., Chicago.
National Lock Washer Company, Newark, N. J.
National Malleable Castings Company, Cleveland, Ohio.
Northwestern Motor Company, Eau Claire, Wis.
Oxweld Railroad Service Company, Chicago.
P. & M. Company, Chicago.
Positive Rail Anchor Company, Marion, Ind.
Pocket List of Railroad Officials, New York City.
Q. & C. Company, New York City.
Rail Joint Company, New York City.
Railroad Supply Company, Chicago.
Railway Review, Chicago
Ramapo Iron Works, Hillburn, N. Y.
Reade Manufacturing Company, Hoboken, N. J.
Reliance Manufacturing Company, Massillon, O.
Sellers Manufacturing Company, Chicago.
Simmons-Boardman Publishing Company, New York City.
Templeton, Kenly & Co., Ltd., Chicago.
Track Specialties Company, New York.
Union Switch & Signal Company, Swissvale, Pa.
Verona Tool Works, Pittsburgh, Pa.
Warren Tool & Forge Company, Warren, O.
Woolery Machine Company, Minneapolis, Minn.
Wyoming Shovel Works, Wyoming, Pa.

Traffic News

An agreement has been made between the Illinois Central and the Mississippi Warrior Barge Line, for a direct interchange of freight at Cairo, Ill. The contracts for the construction of the interchange terminals are in preparation and it is expected the terminal, which will be of the floating barge type, will be in service within 2½ months.

The Salt Lake City Passenger Association, suspended during the war, has been reorganized and has elected the following officers: C. H. Cutting, president; J. E. Light, first vice-president; Frank Yentzer, second vice-president, and A. W. Wagner, secretary and treasurer. The annual convention of the American Traveling Passenger Agents' Association is scheduled to be held at Salt Lake on September 12, 13 and 14.

In addition to the application for a 20 per cent reduction on iron and steel recently decided upon at Chicago by conference of freight traffic managers of transcontinental lines, it has been decided to apply to the Interstate Commerce Commission for a further reduction of 5 per cent in west bound rates on iron and steel from eastern points to the Pacific Coast terminals. The application will be filed with the Interstate Commerce Commission for permission to publish these revised rates to terminals only.

Passenger fares in Canada (eastern territory) are to be reduced on July 1, in accordance with an order which has been issued by the Board of Railway Commissioners. As of September, 1920, the commissioners authorized an increase of 20 per cent in fares, with the understanding that one-half the advance should be taken off on January 1, 1921, and the other half on July 1, 1921; and in accordance with this understanding the present order has been issued. The ordinary rate per mile, after the reduction, will be 3.45 cents.

The transcontinental railroads have filed with the Interstate Commerce Commission an application for fourth section relief to permit the reduction of rates on wool and mohair in carloads from Pacific coast terminals to points in eastern defined territory without corresponding reductions to intermediate points, in order to meet Panama Canal competition. An informal conference was held before the suspension board of the Interstate Commerce Commission on June 16 on a proposed reduction by the transcontinental railroads of the rates on sugar from California coast points to defined territories as far east as Chicago rate points. Various representatives of the sugar industry took different positions on the propriety of the proposed reduction and it was opposed by representatives of the eastern railroads.

Wholesale lumber dealers represented at a hearing at Chicago, before Examiner Butler of the Interstate Commerce Commission, have protested against the ten-dollars-a-day penalty for holding loaded lumber cars at any point longer than 48 hours. The lumbermen want the order passed in October, 1919, repealed. Retail lumbermen attending the meeting argued, however, that cars were made for transportation and not storage purposes, and they asked that the order, made at their request, should remain in effect. Before the order went into effect, they claim, the mills sent out lumber on orders from the commission men and loaded cars were held at different points sometimes for weeks before the lumber was sold. They denied the claim of the wholesalers that the competition created when they were able to hold the lumber on cars for a reasonable time, tended to bring down the prices.

Seasonal Coal Rate Bill Up in the Senate

The bill introduced by Senator Frelinghuysen to authorize the Interstate Commerce Commission to make seasonal reductions in coal rates to stimulate the movement during the early part of the year and corresponding advances in the rates during the latter part of the coal season, was taken up in the Senate on June 20, having been made the unfinished business. It was reported that members of the so-called "agricultural bloc" in the Senate would take advantage of

the opportunity thus afforded to try to press as amendments to the bill some of the various proposed bills to amend the transportation act. There have been numerous bills to repeal the 5½ per cent rate-making rule and also to prevent the Interstate Commerce Commission from interfering with state-made rates, which have been referred to the committee on interstate commerce and have not been acted upon. Senator Frelinghuysen made an opening statement on the bill, which he said has received the approval of Chairman Clark of the Interstate Commerce Commission as well as of the entire interstate commerce committee, and said that unless something is done to stimulate the buying of coal the panic prices of last year may be repeated this winter and transportation may be over-taxed so that a coal shortage will occur. He said the public expects Congress to do something to relieve the coal situation and that they will not endure another season of high prices. There is a great slump in coal buying at the present time and he argued at some length that action is necessary to stimulate coal buying at this time, although he did not discuss the question of how much of a reduction in freight rates would be sufficient to stimulate buying.

Railroads Decline General Reduction in Fruit and Vegetable Rates

In view of the many complaints and communications received by the Interstate Commerce Commission from the different producing sections and chief marketing centers of fruits, vegetables and melons, with respect to the freight rates thereon, the commission after investigations of its own, requested that a committee representing the railroads in the different sections of the country convene at Washington at the earliest practicable date for the purpose of considering the situation.

Such meeting was accordingly held on June 21, at which the complaints filed with the commission were placed before the carriers' representatives, supplemented by data which had come direct to the freight traffic officials of the railroads.

According to a statement issued by the Association of Railway Executives, "consideration was given to the complaints and to the reports of actual market conditions and returns to the producers. Many of the complaints were found to be merely in anticipation of reduced profits and unfavorable markets, but the actual figures demonstrated that the daily and weekly results were generally remunerative. Many sections which had definitely expected poor results were shown to have made more than the usual net profits.

"In no case was it shown that any section of the country was suffering from unduly burdensome rates or from inadequate facilities or service, but, on the contrary, the reports of the Bureau of Markets, United States Department of Agriculture, which are issued daily, as well as information in possession of the carriers, show that fruits, vegetables and melons generally are moving currently in larger quantities than ever before, and are being marketed without difficulty at fairly remunerative prices. The following figures, taken from the June 11 issue of the United States Department of Agriculture Market Reporter, show the increase in movement this year compared with 1920:

	Number of Carloads	
Apples, cabbages, cantaloupes, celery, lettuce, onions, peaches, potatoes, strawberries, tomatoes, watermelons, and mixed vegetables	1921	1920
	367,741	309,181

"In no case was it found that the carriers had failed to furnish, and at greatly increased expense, the adequate and well maintained service so valuable and necessary for this highly perishable traffic, or that there had been any lack of equipment or of facilities for icing and other protection of this traffic in transit or at terminals from which reconsignments were permitted or disposition made to the local markets."

Under these circumstances, announcement was made by the carriers that the evidence presented, both as to the current movement and the movement of fruits, vegetables and melons for the remainder of this season, did not justify a general reduction in the rates on this traffic.

Commission and Court News

United States Supreme Court

Risks on Freight in Car Waiting To Be Taken Into Train

In November, 1917, the Yazoo & Mississippi Valley issued a bill of lading for 31 bales of cotton which had been loaded into a box car at Alligator, Miss., for shipment to Memphis, Tenn. Before the loaded car had been attached to any train or engine it was destroyed by fire. The shipper sued in a state court to recover the value of the cotton. The carrier contended that it was relieved from liability, under section 5 of the Uniform Bill of Lading, providing that property taken from a station at which there is no agent, shall be at the risk of owner until the cars are attached to trains. The shippers insisted that the provision did not apply, because at Alligator there was a regularly appointed agent and that the place where the car was received was, in effect, a part of the carrier's terminal and not a "private or other siding" within the meaning of the provision. The cotton had been loaded from the platform of a gin situated at the blind end of a spur which leads from the main line at a point near the station. The spur, which is 1,000 ft. long, had been built by the railroad many years before at its own expense. About half of it is on the railroad right of way and runs parallel to the main line; the rest is on private land. The spur is used generally by the public for loading and unloading carload freight. A verdict was directed for the shippers. Judgment thereon was affirmed by the Supreme Court of Mississippi on the ground that the quoted clause applies only to stations at which there is no regularly appointed agent; 120 Miss. 690. In the appellate courts of the states in which the question has arisen the decisions are conflicting. For this reason a writ of certiorari was granted, 251 U. S. 550. The only question requiring decision was whether the court below gave the correct construction to the clause. The United States Supreme Court holds that it did. The court said: "It could not have been intended that at stations where there are regularly appointed agents outgoing loaded cars for which bills of lading have issued and which are left standing on a siding solely to await the carrier's convenience are to be at the risk of the shipper. And this is true whether the siding be strictly public or semi-public, a siding privately used but owned by the railroad. The fact that the spur extends over land not part of the carrier's right of way is immaterial. Yazoo & Mississippi Valley v. Nichols & Co. Decided June 1, 1921. Opinion by Mr. Justice Brandeis.

Assessment of Railroads in Arkansas for Highway Improvements Held Excessive

The Kansas City Southern and the Texarkana & Fort Smith were assessed by a road improvement district in Little River County, Arkansas (the district including about 25,000 acres of agricultural land and 9.7 miles of railroad owned by the companies), on account of a proposed gravel-road of 11.2 miles, at $7,000 per mile of main track—$67,900. Other property was assessed without reference to value or improvements, according to location. The railroads maintained that the assessment was unequal, arbitrary, unreasonable and unconstitutional. The state courts held to the contrary and declared the assignment valid. The Supreme Court of the United States has reversed the State Supreme Court's judgment, saying, in part: "Obviously, the railroad companies have not been treated like individual owners, and we think the discrimination so palpable and arbitrary, as to amount to a denial of the equal protection of the law. Benefits from local improvements must be estimated upon contiguous property according to some standard which will probably produce approximately correct general results. To say that 9.7 miles of railroad in a purely farming section, treated as an aliquot part of the whole system, will receive benefits amounting to $67,900 from the construction

of 11.2 miles of gravel road seems wholly improbable, if not impossible. Classification, of course, is permissible, but we can find no adequate reason for what has been attempted in the present case. Royster Guano Co. *v.* Virginia, 253 U. S., 412, 415. It is doubtful whether any very substantial appreciation in value of the railroad property within the district will result from the improvements; and very clearly it cannot be taxed upon some fanciful view of future earnings and distributed values, while all other property is assessed solely according to area and position. Railroad property may not be burdened for local improvements upon a basis so wholly different from that used for ascertaining the contribution demanded of individual owners as necessarily to produce manifest inequality. Equal protection of the law must be extended to all." Kansas City Southern *v.* Road Improvement District. Decided June 6, 1921. Opinion by Mr. Justice McReynolds.

Railroads Must Pay for Use of Shippers' Diverted Tank Cars

In an action by the owner of tank cars for payment for their detention and diversion for other shipments after delivery of the plaintiff's goods, it appeared that the railroad refused to pay for the use of the cars beyond the rate fixed by the Interstate Commerce Commission for empty mileage on tank cars. The Federal District Court for the Southern District of New York holds that rule 29 of the Commission does not authorize the railroad to detain or divert cars at will, and that for such detention and diversion beyond a reasonable time for their return, the railroad must pay the owner a fair amount. The railroad also argued that the A. R. A. rule forbids payment of the kind here sued for. That rule provides that the carriers will pay nothing for delay or diversion except as authorized in tariffs. But this, says the court, is not an assertion of any right deliberately to divert such cars; the practice is to observe the shippers' orders in the return of cars. Such detention remains, therefore, a wrong, both under the regulations and at common law.

The railroad contended that the carriers have nevertheless established a practice by which they have interpreted Rule 29 as covering the case of cars which happen to be delayed or diverted and that this practice must be reviewed by the commission before it can come before any court. The court, however, doubted whether there has been any consistent practice among the carriers on this subject. "Occasional, and even common, assertions of right do not make such a 'practice.' Its essence is its uniformity. Carriers may not claim the sanction of the statute for a usage which they apply only with exceptions. They cannot say that in such cases they 'observe and enforce' it themselves." The court added that the three cases in which the question has already arisen have been decided against the carrier. Gustafson *v.* Michigan Central, 296 Ill., 41, 129; N. E., 516 (Feb. 3, 1921); Sun Co. *v.* Pennsylvania, Pennsylvania Court of Common Pleas, July term, 1920; Empire Refineries v. Mo. Pac., C. C. A. 8th Circuit, March 17, 1921; Macklin, Brown, etc. *v.* Baltimore & Ohio. Dist. Ct., S. D., N. Y. Decided June 1, 1921.

In the Gustafson case the railroad was held liable for negligence in delaying unreasonably the return of an empty tank car, the mileage rate filed with the commission referring to the Railroad's use of the car and not to unreasonable delay in its return.

In the Empire Refineries case, 271 Fed., 668, a tank car owned by a shipper, filled with gasoline, was delivered to a railroad for the transportation of the gasoline to a consignee under a bill of lading entitling the owner to payment for the use of the car on a mileage basis. The car was not delivered to the consignee, but diverted, and was not returned to the owner for three months. The Circuit Court of Appeals held that the railroad was a bailee for hire of the car, for its use only according to the bill of lading; that the diversion was a breach of the contract of bailment, which, whether intentional or negligent, rendered the company liable to the owner for all damages, including the value of its use during detention.

Foreign Railway News

Alcohol Locomotives in Brazil

In the vicinity of Pernambuco, Brazil, according to Consul C. R. Cameron, are some 80 sugar factories which operated approximately 800 miles of railways of from .75 meter to 1 meter gage. At the present time wood is the principal fuel but the supply of this fuel is not great and considerable interest is being manifest in the substitution of alcohol which can be manufactured in large quantities as a sugar by-product. The current price of alcohol, says Consul Cameron, is 22 cents a gallon, although the cost of production is much less. Mr. Cameron is impressed, consequently, with the opportunities in this section for American concerns manufacturing locomotives using alcohol as a fuel.

April Exports of Car Wheels and Axles

Exports of car wheels and axles in April were valued at $304,659—a slight increase over the previous month. Brazil was the destination of this material to the value of $93,089. Detailed figures, as compiled by the Bureau of Foreign and Domestic Commerce, follow:

Countries	Dollars	Countries	Dollars
Canada	18,757	Chile	52,183
Honduras	3,428	Colombia	600
Nicaragua	765	Ecuador	2,266
Panama	1,078	Peru	10,194
Mexico	18,879	Venezuela	649
Jamaica	308	China	27,830
Trinidad and Tobago	3,316	Kwantung, leased territory	3,950
Other Brit. West Ind.	612	Japan	62,511
Cuba	1,181	Philippine Islands	1,913
Dominican Republic	186	British South Africa	544
Argentina	420		
Brazil	93,089	Total	304,659

South African Railways Deficit

LONDON

The report of the South African Railways and Harbors for the year ending March 31, 1921, shows an estimated deficit of approximately $3,500,000, instead of an anticipated surplus of $750,000. This is due to the increased cost in wages, necessitated by the increase in the cost of living, which involved an additional expenditure of over $3,650,000 per annum. To meet this increase in expenditure the rates were raised as from October 1, 1920, but owing to the falling off of both passenger and freight traffic, this increase was found to be far below expectations.

The total tonnage of freight, coal and minerals carried during 1920, was 16,164,700 tons, or an increase of 11.27 per cent over the previous year.

Some interesting figures were given by J. W. Jagger, the minister responsible for the South African Railways and harbors, as follows:

Gross capital expenditure of both Railways and Harbors at December 31, 1920	$530,000,000
Gross expenditure on Rolling Stock in 1920	$21,000,000
New Rolling Stock brought into service in 1920:	
Locomtives	113
Passenger cars	120
Freight cars	1919

It is estimated that the deficit for the financial year ending March 31, 1922, will amount to $2,940,000, which, added to the accumulated deficit to the end of March, 1921, namely, $12,300,000, will amount to $15,300,000 for the year ending March, 1922.

Equipment Situation in Russia

An exchange telegraph dispatch states that on January 1, there were 7,729 locomotives suitable to run and 10,714 locomotives laid up for repairs in Russia. Likewise there were 358,552 freight cars fit for service and 96,580 in bad order. The repair work done in 1920 exhausted the supply of material for repairs and it was necessary to rob some of the bad order equipment of its material. In the summer of 1920, a program of repairs for four and a half years was adopted, but in the last half of that year only 30 per cent of the repairs scheduled to be done were completed. For 1921, this schedule was reduced 40 per cent, but in January and February only 10 per cent of the reduced schedule was com-

pleted. It is now stated that the Supreme Council of National Industry reports that owing to the lack of material the plans for repairing rolling stock cannot be carried through.

Objections to English Railway Bill

The English Railway Bill (*Railway Age*, May 27, page 1209) has aroused considerable criticism. Labor representatives claim that the amounts to be allowed the companies for settlements of claims against the government are too large. They also object to the bill because it does not provide for government ownership. The Scottish railways object to the provisions of the bill relating to the settlement of disputes with labor because they fear the perpetuation of the present standards of wages. Higher rates do not solve the problem of high wages, they say in effect, because they drive away traffic. The Scottish companies have suffered more from increased costs and decreased earnings than the English roads proper. Many of the railways are objecting to the compulsory consolidations called for by the bill, and shippers are not satisfied with the provisions for the regulation of rates. The railways object, too, to the extensive state control proposed in the bill.

Government Authorizes Increased Rates on Mexican Railway

A report from Assistant Trade Commissioner Connell states that, by authorization of the federal government, the transportation rates of the Mexican Railway, a British property, are to be increased 25 per cent, placing them on a par with those collected by the government lines. However, one-half of the additional gross receipts resulting from this increase in rates will be considered as amortization by the government on its debt to the Mexican Railway, which amounts to some millions of pesos. This will obviate the withdrawal of funds from the treasury in order to decrease the obligation, and is apparently a new policy which will be adopted by the Secretary of Finance to cancel many of the claims for damages and losses of property and equipment arising during the time of political disturbance.

April Locomotive Exports

Exports of steam locomotives in April fell to 66, valued at $1,922,487, from the March total of 105, valued at $5,317,029. The largest shipments, 20 valued at $567,610, were destined for Brazil. Eighteen, valued at $422,362, went to Mexico. The detailed figures by countries, as compiled by the Bureau of Foreign and Domestic Commerce, follow:

Countries	Number	Dollars
Malta, Gozo, and Cyprus Islands	1	14,548
Canada	1	3,750
Honduras	1	17,550
Mexico	18	422,362
Cuba	5	162,430
Brazil	20	567,610
Peru	4	128,430
China	2	70,800
Hongkong	4	75,200
New Zealand	1	14,957
Philippine Islands	5	268,500
Egypt	4	176,350
Total	66	1,922,487

Trade Commissioner Predicts Large Purchases of Supplies in India

Trade Commissioner Batchelder, according to Commerce Reports, is much impressed with the opportunity for the sale of railway supplies and equipment of all kinds, which will exist in India as soon as the plans for modernizing the antiquated railways of that country take definite form. Large loans have been floated in England recently for improving the Indian railways but, in view of the fact that the necessity for additions and betterments is so great, still greater capital expenditures will probably be undertaken as soon as possible. Commissioner Batchelder believes that an opportunity exists at the present time for the formation of a car trust to supply rolling stock to the roads. Rolling stock is not the only need—double tracking, new terminals and additions to yards and sidings are also contemplated.

Equipment and Supplies

Locomotives

THE PEKIN-SUIYUAN will ask for bids about July 20, through the Universal Steel Export Company, 26 Cortlandt street, New York City, for 7 Mallet type locomotives, 25 Mikado type and 5 Pacific type.

Freight Cars

THE ATLANTIC FRUIT COMPANY, 61 Broadway, New York City, is inquiring for 100 cane cars of 20 tons' capacity and 36 in. gage.

THE PITTSBURGH & WEST VIRGINIA has ordered 300 hopper car bodies of 55 tons' capacity from the Cambria Steel Company.

THE WESTERN MARYLAND is inquiring for 500 hopper car bodies of 55 tons' capacity, also asking for prices on the repair of 500 hopper cars of 50 tons' capacity.

THE PEKIN SUIYUAN will ask for bids about July 20, through the Universal Steel Export Company, 26 Cortlandt street, New York City, for 400 high side, steel freight cars of 40 tons' capacity.

Miscellaneous

THE NEW YORK CENTRAL will receive bids until 12 o'clock noon, July 6, for its requirements until October 1, 1921, for the line Buffalo and East, of fuel oil, gasolene, kerosene, long-time burning semaphore oil, turpentine substitute, gas oil and tallow candles.

The BOSTON AND ALBANY will receive bids until 12 o'clock, noon, July 7, at Boston, Mass., for: 2 trailing truck wheel centers; 3 type E power reverse gears; 2 sand box bodies; 6 pressed steel small front doors; 6 cast steel trailer yoke seats, and 2 steam chest relief valves.

THE NORFOLK & WESTERN will receive bids until 12 o'clock noon, July 6, at Roanoke, Va., for repair parts for Westinghouse engine; parts for electrical apparatus; parts for electric pump; 400 rods of wire fencing; 2,000 double coil draft gear springs, approximately 40,000 lb., and soft steel bars.

THE CENTRAL OF NEW JERSEY will receive bids until 12 o'clock noon, July 6, for the work of repairing, rebuilding, refitting and finishing of its marine floating equipment, including Sandy Hook steamers, tugs, barges, car floats, derricks, lighters, etc., for the period of one year from July 6, 1921, to July 6, 1922. Bids will also be received until 12 o'clock, noon, July 11, for anthracite locomotive fuel coal for delivery at Ashley, Mauch Chunk, Phillipsburg, or Jersey City, as follows: Broken, 60,000 gross tons; buckwheat No. 1, 420,000 tons; buckwheat No. 2, 45,000 tons; pea, 46,000 tons.

Signaling

THE CANADIAN NORTHERN has ordered from the General Railway Signal Company of Canada a mechanical interlocking, 12 levers, for the Trent Canal drawbridge at Washago, Ont.

Railway Construction

ATCHISON, TOPEKA & SANTA FE.—This company will shortly receive bids for the installation of two new 120-ft. turntables, one at Winslow, Ariz., and the other at Needles, Cal., to cost about $45,000 each.

CHICAGO & ILLINOIS MIDLAND.—This company has awarded a contract for the construction of a 150-ton concrete coaling station at Humphrey, Ill., to the Ogle Construction Company, Chicago.

Supply Trade News

The Morkrum Company, Chicago, has opened an office at 707 World building, New York, in charge of **J. B. Appleton,** assistant manager sales, engineering department.

The Canadian Locomotive Company, Ltd., Kingston, Ontario, is carrying out improvements at its shops, to include two additional pits to the erecting shop and the construction of a storage building 200 ft. by 75 ft.

M. E. Lisle, assistant to the president of the **Terminal Engineering Company, Inc.,** 17 West Forty-fourth street, New York City, has been elected vice-president and **M. E. Peck,** office manager, has been elected secretary and assistant treasurer.

A. H. Dodge has been appointed sales manager of the **J. G. Wilson Corporation,** 8 West Fortieth street, New York City. **E. Doscher** has been appointed assistant sales manager and district manager for New York; **S. H. Monsces** has been appointed general sales correspondent and **H. S. Tompkins,** formerly of the Western Electric Company, will specialize on Diffuselite fixtures.

The Link-Belt Company, Chicago, has acquired all of the capital stock of the **H. W. Caldwell & Son Company,** Chicago, and **Frank C. Caldwell** has been elected a director of the Link-Belt Company. The Caldwell Company's plant will continue to operate under separate corporate existence, under its present name, and the plant management will remain substantially the same as heretofore.

Harry W. Torney, of Torney & Co., New York, was recently elected president of the **Sharon Pressed Steel Company** with office at 66 Broadway, New York City. This company was recently reorganized. **Arthur W. Swan** is now general manager in charge of manufacture; he was formerly chief engineer and works manager of the Crucible Steel Company and its associates. **J. G. White** has been appointed district sales manager at Detroit, Mich. The company recently installed some new machinery at its plant, Sharon, Pa.

William Aldrich, who has recently been in charge of thermit welding in the Southern territory of the **Metal & Thermit Corporation,** New York, has been transferred to the Western territory. **William H. Moore,** who recently was assigned to the Chicago territory, now has charge of the Southern territory. This corporation has constructed and will shortly place in operation in South San Francisco, Cal., a large new plant for the production of detinned billets, in addition to the detinning plants already operated by this company for several years at Chrome, N. J., and East Chicago, Ind. **E. Kardos,** superintendent, will be in charge of the new plant which includes a large welding shop. The estimated cost of this plant is $800,000. The San Francisco offices of the corporation have been removed from 329-333 Folsom street, to the new South San Francisco plant.

Obituary

William Jordan Caton, secretary of the Burden Iron Company, Railroad and Steamship Division, and assistant to the president of the Sanitation & Supply Company, New York, died on June 17, in the Harbor Hospital, Bath Beach, Brooklyn, N. Y., at the age of 66. He began railway work in the auditor's department of the Boston & Albany at Springfield, Mass., and subsequently served in the passenger department of the same road. He was later purchasing agent of the Pittsburgh & Lake Erie. He served for about nine years as New York representative of Brown & Co., Inc., Pittsburgh, Pa., until July, 1920, when he left the service of that company to go to the Burden Iron Company, Railroad and Steamship Division.

Railway Financial News

CAMBRIA & INDIANA.—*Application for Loan.*—This company has applied to the Interstate Commerce Commission for a loan of $750,000 for 10 years, payable at the rate of $75,000 a year, for the purchase and liquidating of two-year, 6 per cent gold notes maturing on August 1.

CENTRAL RAILROAD OF SOUTH CAROLINA.—*Authorized to Issue Bonds.*—This company has been authorized by the Interstate Commerce Commission to issue and exchange or sell at par and accrued interest $300,000 of serial 6 per cent refunding bonds, to retire a like amount of first mortgage bonds.

CHESAPEAKE & OHIO.—*Again Defers Dividend.*—The directors on June 17 again deferred action on the usual dividend of 2 per cent for the current half year. Action thereon was deferred at the May meeting also.

New Director.—W. J. Louderback, of Chicago, has been elected a director to succeed F. H. Davis, deceased.

CHICAGO & EASTERN ILLINOIS.—*Authorized to Extend Time for Issuing Securities.*—The Interstate Commerce Commission has issued a supplemental order extending the time within which the company may issue securities as authorized in its order of February 3 from June 30, 1921, to January 1, 1922.

Application to Discontinue Operation of C. & I. Coal Railway.—R. D. Stephens, co-receiver, has applied to the commission for certificate authorizing the abandonment of operation of the Chicago & Indiana Coal Railway Division on the ground that the traffic is insufficient to justify the operation.

CHICAGO, INDIANAPOLIS & LOUISVILLE.—*Authorized to Pledge Bonds.*—This company has been authorized by the Interstate Commerce Commission to pledge and repledge from time to time $3,493,000 of first and general mortgage 5 per cent gold bonds as collateral security for short term notes.

CHICAGO, MILWAUKEE & ST. PAUL.—*Bonds Due July 1 Provided For.*—This company has announced that the $1,360,000 Chicago & Lake Superior divisional first mortgage 5s, and the $4,755,000 Wisconsin & Minnesota divisional first mortgage 5s, due July 1, next, have been provided for, and that no new financing is contemplated this year.

CHICAGO UNION STATION.—*Asks Authority to Issue Bonds.*—This company, the Chicago, Burlington & Quincy, the Chicago, Milwaukee & St. Paul, and the Pittsburgh, Cincinnati, Chicago & St. Louis have filed a joint application with the Interstate Commerce Commission for authority to issue and sell $6,000,000 of first mortgage 6½ per cent gold bonds, dated January 1, 1920, and maturing July 1, 1963, and also for authority to the owning companies to guarantee the principal and interest. The proceeds are to be used to continue the construction of the passenger terminal in Chicago. The bonds are to be redeemable at the option of the company on January 1, 1935, or thereafter at 110. They have been disposed of, subject to the commission's approval, at 97½ to Kuhn, Loeb & Co., Lee, Higginson & Co., Illinois Trust & Savings Bank, National City Company, and the First National Bank.

DELAWARE, LACKAWANNA & WESTERN.—*Annual Report.*—A review of this company's annual report for 1920 appears on another page of this issue.

DENVER & RIO GRANDE.—*B. B. Odell Resigns from Stockholders' Committee.*—Benjamin B. Odell has resigned as chairman of the Stockholders' Protective Committee, which has been endeavoring, through a court contest, to set aside the sale of the Denver & Rio Grande to the Western Pacific. He gave as his reason the pressure of other business.

The committee has ordered that appeals be taken from the orders entered in the United States District Court at Denver

confirming the sale of the property on grounds including the following:

Entire proceedings are irregular, because, based upon the original judgment for $38,000,000, which the committee holds should be enjoined; decree erroneously cut off the six month period of redemption allowed by laws of Colorado, New Mexico and Utah; court is declared to have no power to sell the franchise; price of $5,000,000, at which the properties were sold, is declared so grossly inadequate as to shock the conscience; Denver property, it is said, was sold at the upset price of $5,000,000, whereas the treasury assets included in the sale, consisting of stocks and bonds, had a clear stock exchange value of more than $8,000,000.

FLINT BELT.—*Application to Abandon Line.*—This company has applied to the Interstate Commerce Commission for a certificate authorizing the abandonment of 13½ miles of line in Genesee County, Mich.

GREAT NORTHERN.—*Regular Dividend Declared.*—This company has declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable August 1 to holders of record July 2. No statement was issued by the company regarding this payment.

HOCKING VALLEY.—*Again Defers Dividend.*—The directors on June 16 again deferred action on the regular semi-annual dividend of 2 per cent.

New Director.—G. B. Wall, of Richmond, has been elected a director to succeed F. H. Davis, deceased.

HUNTINGDON & BROAD TOP MOUNTAIN.—Asks Authority to *Issue Equipment Trusts.*—This company has applied to the Interstate Commerce Commission to issue $300,000 of car trust certificates for the purchase of four locomotives and 10 passenger cars, to cost $411,393. Certificates are to be sold to W. M. Canby and Robert Glendenning.

ILLINOIS CENTRAL.—*Annual Report.*—The corporate income for the year ended December 31, 1920, compares with the corporate income for the year 1919, as follows:

	1920	1919	Increase or decrease
Operating revenues	$121,804,579	.....	.....
Operating expenses	121,874,327	.....	.....
Expenses over revenues	69,748	.....	.....
United States Government—guaranty period claim	$19,499,887	.....	.....
Rental from United States Railroad Administration	3,399,635	$17,896,467	—$14,496,832
Railway operating income	$22,829,773	$17,896,467	$4,933,306
Operating expenses, corporate, not assumed by United States Railroad Administration	$117,658	$351,633	—$233.975
Federal War income and other taxes	7,172,262	853,200	6,319,062
Uncollectible railway revenues	23,320	.....	23,320
Railway operating income over corporate expenses, taxes and and uncollectible railway revenues	$15,516,534	$16,691,635	—$1,175,101
Equipment rents—net credit	3,196,849	.....	3,196,849
Joint facility rents—net debit	191,297	.....	191,297
Net railway operating income	$18,522,085	$16,691,635	$1,830,450
Income from investments and other corporate income	7,219,882	7,634,005	—414,123
Gross income	$25,741,967	$24,325,639	$1,416,328
Interest on funded debt and other miscellaneous corporate charges	12,170,845	12,156,720	14,125
Net income	$13,571,122	$12,168,919	$1,402,203
Disposition of net income:			
Income applied to sinking and other reserve funds	$118,200	$118,200	.....
Income appropriated for investment in physical property	18,081	170,100	—$152,019
Total appropriations of income	$136,281	$288,300	—$152,019
Income balance transferred to profit and loss	$13,434,841	$11,880,619	$1,554,222

The annual report of the Illinois Central will be reviewed editorially in an early issue.

LEHIGH VALLEY.—*Another Extension Granted.*—Judge Charles M. Hough in the United States District Court at New York has granted this company an extension of time until July 24 for filing a plan for segregating its properties. This is the second extension of time secured by the company.

LOUISVILLE & NASHVILLE.—*To Increase Capital Stock.*—Notice has been sent to the stockholders that a special meeting will be held July 23, 1921, at Louisville, Ky., for the purpose of considering the proposed increase of the company's capital stock and a distribution among the stockholders (in the form of a stock dividend) of surplus earnings invested in property and of taking action on the authorization of a proposed first and refunding mortgage. The notice was accompanied by a letter from President W. L. Mapother which referred to the proposed action as follows:

At the regular annual meeting of the stockholders held April 6, 1921, a first and refunding mortgage for the purpose of retiring existing bonds and other indebtedness of this company and for other purposes was authorized, and will involve an ultimate issue of bonds in excess of the company's present indebtedness.

The most liberal and secure basis of such mortgages by the large systems of railroads needing large amounts for construction of extensions, for additions and betterments and to provide for refunding future maturities of existing bond issues, is to insert a condition that at no time shall the amount of bonds issued under such mortgage exceed at par three times the par value of the stock issued and outstanding. This happens to be almost the exact present ratio of the company's funded debt to its present capital stock—a ratio which the proposed new mortgage will necessarily disturb.

The obvious remedy is to increase the capital stock, for if the company is to maintain its present standard of excellence and to go forward in the development of the vast tonnage of the future, it must be placed in a position to offer the public investment securities which will be approved and recommended by the most conservative bankers.

For these reasons, and in order to provide for future expansions, the management decided to recommend that the authorized capital stock be increased from 720,000 shares to 1,250,000 shares of $100 par value each.

Having reached this conclusion, the question arose as to whether the additional stock should be sold or distributed to the stockholders as a stock dividend. As bearing upon this question, the records of the Louisville & Nashville disclose the following facts:

The company's surplus as of December 31, 1920, stands at $82,985,890, and all discounts from the sale of bonds since 1902, aggregating approximately $7,000,000, have been charged off to profit and loss. The annual amounts of surplus earned closed into profit and loss account, less dividends paid, aggregate (speaking in round numbers) about $96,000,000. This does not include the items of depreciation of equipment (which stands on the books at $30,900,097), and of depreciation of certain items of roadway (which stands on the books at $13,796,051).

In view of the foregoing facts, showing that the proposed increase of stock represents the previous earnings of the company (and merely a part of them) which were used to increase the property investment instead of being distributed in dividends, the management has decided it to be right and proper that there be issued to the stockholders ratably as a stock dividend so much of the $53,000,000 increase of capital stock as the Interstate Commerce Commission shall authorize to be so issued.

MARSHALL & EAST TEXAS.—*Certificate for Abandonment Held Not Necessary.*—The Interstate Commerce Commission has reaffirmed its original finding that a certificate authorizing the abandonment of this line is not necessary, on the ground that the abandonment took place prior to the effective date of paragraph 18 of the Interstate Commerce Act. A reargument in the case was held at the request of the applicant, but the commission finds that the cessation of operation of this particular road amounted to complete abandonment, as evidenced by the commencement of proceedings in the federal court for the sale of the line as scrap.

MISSOURI, KANSAS & TEXAS.—*Asks Authority to Extend Certificates.*—The receiver has applied to the Interstate Commerce Commission for authority to extend for one year a series of $3,000,000 of receivers' certificates bearing interest at 6 per cent instead of 5 per cent.

MISSOURI PACIFIC.—*Asks Authority to Issue Bonds.*—This company has applied to the Interstate Commerce Commission for authority to issue and sell or pledge from time to time $5,501,500 of its first and refunding mortgage 6 per cent gold bonds now held in the treasury. It is proposed to sell the bonds at some future time at not less than 90, or to pledge them at not less than 75. No contracts have been made for their disposal.

MONONGAHELA.—*Asks Authority to Pledge Bonds.*—This company has applied to the Interstate Commerce Commission for authority to issue $1,300,000 of 6 per cent first and refunding mortgage bonds to be pledged with the Secretary of the Treasury as security for a loan of $1,000,000.

NEW YORK, NEW HAVEN & HARTFORD.—*To Pay July 1 Interest.*—President E. J. Pearson has issued the following statement replying to a report that the New Haven was going to default on the debenture bond interest July 1:

The affairs of the New Haven show improvement. Revenues during the month of June have increased. Expenses have decreased, owing to the decreased cost of coal and materials. After July 1, labor costs will be still less. The divisions case is yet to be heard from. There is no doubt in the mind of the management that the New Haven will meet its interest, rentals and other fixed charges on July 1.

NORTHERN PACIFIC.—*Regular Dividend Declared.*—This company has declared the regular quarterly dividend of 1¾ per cent, payable August 1 to stock of record July 2.

Howard Elliott, chairman of the board, made the following statement: "This payment is not from earnings of the property in 1921, which, in common with other railroads, have been on a lower level than in previous years, but out of surplus heretofore accumulated and not distributed."

OCEAN SHORE.—*Abandonment of Line Authorized.*—The Interstate Commerce Commission has issued a certificate of public convenience and necessity authorizing the abandonment of this company's line, extending from San Francisco to Tunitas Glen, and a second line from Santa Cruz to Swanton, Cal.

PATTERSON & WESTERN.—*Abandonment of Line Authorized.*—This company has been authorized by the Interstate Commerce Commission to abandon its line from Patterson to Jones Station, Cal., a distance of 23.6 miles.

PEARL RIVER VALLEY.—*Application for a Certificate Held Unnecessary.*—The Interstate Commerce Commission has rendered a decision that the proposed relocation of a portion of the main line in Pearl River county, Miss., does not require a certificate as it does not constitute an abandonment of a line within the meaning of paragraph 18 of the interstate commerce act. The new line is within a mile of the former location.

PENNSYLVANIA.—*Authorized to Acquire Control.*—This company has been authorized by the Interstate Commerce Commission to acquire control of the Pittsburgh, Fort Wayne & Chicago by the purchase at par from the Pennsylvania Company of $34,000,000 of special guaranteed stock and as part consideration therefor to assume the obligations of the Pennsylvania Company in respect of the payment of the principal and interest of $33,239,000 of guaranteed trust certificates heretofore issued by that company.

PITTSBURGH, CINCINNATI, CHICAGO & ST. LOUIS.—*Dividend Deferred.*—The directors at their meeting in Philadelphia on June 22 decided to postpone consideration of the regular 2 per cent semi-annual dividend until later in the year. The following statement was issued:

The directors decided, in view of existing low earnings and prevailing adverse conditions, to postpone consideration of the dividend on stock of the company until later in the year by which time earnings for the year and final results of the reduction of wages by labor board and its action respecting the national agreements and working conditions can be ascertained; also settlements with government for the federal control and guaranty periods will no doubt be definitely determined.

All of the capital stock of the company excepting about 1 per cent is owned by the Pennsylvania company.

PITTSBURGH, SHAWMUT & NORTHERN.—*Asks Authority to Lease Road.*—The receiver has applied to the Interstate Commerce Commission for authority to lease the road of the Rochester, Hornellsville & Lackawanna, 10.13 miles.

READING COMPANY.—*Appeal to United States Supreme Court Granted.*—An appeal has been taken by the Continental Insurance Company and the Fidelity-Phoenix Fire Insurance Company, common stockholders of the Reading Company, from the decision of the United States District Court at Philadelphia, holding that the preferred and common stockholders of the Reading Company should share equally. Federal Judge Thompson, at Philadelphia on June 16, allowed the appeal and required the insurance companies to file an indemnity bond of $750,000.

The appeal is limited to that portion of the decree deciding that the common and preferred stockholders have equal rights in the new coal company stock. The segregation plan will be carried out in all respects, including merger of the Reading Company and the Philadelphia & Reading Railway, and the trusteeing of stock, and up to issuing of certificates of interest of the coal company to the trustees.

From that point proceedings are stayed pending a decision by the United States Supreme Court.

Charles Heebner, counsel for the Reading Company, said any modification would seriously upset the plan and cause a great setback in carrying out the decision of the Supreme Court. He said that other plans had been considered, but the present one had been adopted as just and equitable to all interests. In adopting the plan he said the company gave up valuable charter rights to protect common and preferred stockholders. If the contention of the common stockholders is upheld by the Supreme Court, he intimated that the company would ask to submit an entirely new plan which would not contemplate merger of the Reading Company and the Railway Company.

It is expected that the Prosser Committee, representing certain large holders of Reading common stock, will take appeal from the Reading decree of segregation. The sub-committee, representing the largest of these stockholders, of which E. P. Maynard, president of the Brooklyn Trust Company, is chairman, has sent out letters asking that the legal expenses of the undertaking be underwritten by the largest stockholders whose proxies are held by the Prosser Committee.

TERMINAL RAILROAD ASSOCIATION OF ST. LOUIS.—*Authorized to Issue Bonds.*—This company has been authorized by the Interstate Commerce Commission to issue nominally $719,000 of general mortgage bonds to reimburse the treasury for expenditures for additions and betterments.

WESTERN PACIFIC.—*Settlement for $8,646,053 with Government.*—President Alvin W. Krech, in a letter to the stockholders dated June 15, stated that the company had effected a final settlement of all claims against the government, equivalent to a net payment of $8,646,053.

Guaranty Certificates Issued

The Interstate Commerce Commission has issued certificates for partial payments on account of the six months' guaranty for 1920 as follows: Missouri Pacific, $1,100,000; Shearwood, $2,000; St. Louis-San Francisco, $30,000; New York, Susquehanna & Western, $205,000; Ocilla Southern, $15,000.

Settlements With Railroad Administration

The Railroad Administration has announced a final settlement with the Southern Railway covering the adjustment of accounts for the period of federal control, by which the Southern receives a lump sum of $6,000,000. The company's claim is understood to have been in the neighborhood of $35,000,000, but the settlement represents a deduction of the amounts devoted by the government for capital expenditures. The Railroad Administration has also settled with the Chicago & Western Indiana for $450,000, the Belt Railway of Chicago for $140,000 and the Richmond Terminal Railway has paid to the administration $17,157.42.

The payment of these claims on final settlement is largely made up of balance of compensation due, but includes all other disputed items as between the railroad companies and the railroad administration during the 26 months of federal control.

Dividends Declared

Atlantic Coast Line.—Common, 3¼ per cent, payable July 11, to holders of record June 25.

Canada Southern.—1½ per cent, semi-annually, payable August 1, to holders of record July 1.

Cleveland, Cincinnati, Chicago & St. Louis.—Preferred, 1¼ per cent, quarterly, payable July 20, to holders of record July 1.

Detroit River Tunnel.—3 per cent, semi-annually, payable July 15, to holders of record July 8.

Grand Trunk Railway Guaranteed Stock.—2 per cent, payable June 30, to holders of record June 3.

Great Northern.—Preferred, 1¾ per cent, quarterly, payable August 1, to holders of record July 2.

Joliet & Chicago.—1¾ per cent, quarterly, payable July 5, to holders of record June 22.

Kansas City Southern.—Preferred, 1 per cent, quarterly, payable July 15, to holders of record June 30.

Louisville & Nashville.—3½ per cent, payable August 10, to holders of record July 12.

Michigan Central.—2 per cent, semi-annually, payable July 29, to holders of record July 1.

New York Central.—1¼ per cent, quarterly, payable August 1 to holders of record July 1.

Northern Pacific.—1¾ per cent, quarterly, payable August 1, to holders of record July 2.

Northern Securities.—4 per cent, payable July 9, to holders of record June 29.

Philadelphia & Trenton.—2½ per cent, quarterly, payable July 10, to holders of record July 1.

Pittsburgh & Lake Erie.—$2.50, semi-annually, payable August 1, to holders of record July 15.

Reading Company.—Common, 2 per cent, quarterly, payable August 11, to holders of record July 19; first preferred, quarterly 1 per cent, payable September 8, to holders of record August 23.

United New Jersey Railroad & Canal Company.—2½ per cent, quarterly, payable July 10, to holders of record June 21.

MODESTY IN ADVERTISING—"Empty freight cars continue to obstruct some of the views along the Erie system, but they are on sidings in Ohio and Indiana and not along the Delaware or Susquehanna rivers."—*Erie Railroad Magazine.*

THE ALABAMA, TENNESSEE & NORTHERN has made a reduction of 16⅔ per cent in passenger rates. The decrease applies on one-way and round-trip fares with a return limit of thirty days. A decrease of 33⅓ per cent is made on round trip rates with a return limit of five days.

Railway Officers

Executive

Frank H. Hamilton, secretary and treasurer of the St. Louis-San Francisco, with headquarters at St. Louis, Mo., has been elected vice-president, secretary and treasurer, with the same headquarters, effective June 9.

Financial, Legal and Accounting

R. F. Humble has been appointed general auditor of the Arkansas & Louisiana Missouri, the Mansfield Railway & Transportation and the Louisiana & Pine Bluff with headquarters at Shreveport, La., effective June 1.

Operating

F. J. Slimer has been appointed car accountant of the Louisiana & Arkansas, with headquarters at Stamps, Ark., effective June 1.

Frank N. Spencer has been appointed general manager of the Chestnut Ridge with headquarters at New York City, succeeding W. L. Coursen, resigned.

G. D. Dager, superintendent of the Adirondack division of the New York Central, has had his jurisdiction extended over the Ottawa division and the Ottawa & New York, effective June 20.

C. E. Lanham, superintendent of car service of the Gulf, Mobile & Northern, with headquarters at Mobile, Ala., has been appointed superintendent of car service of the Birmingham & Northwestern, with the same headquarters, effective June 15, succeeding W. H. Trice, car accountant, who has resigned.

R. H. Janes, trainmaster of the Chicago, Milwaukee & St. Paul, with headquarters at Mason City, Iowa, has been given jurisdiction over the territory to Rapid City, S. D., including the entire Iowa and Dakota division. **D. A. Gibson,** trainmaster, with headquarters at Mitchell, S. D., has been assigned to other duties and the position of trainmaster abolished. The changes were effective June 11.

B. W. Procter, whose promotion to assistant general manager of the International & Great Northern, with headquarters at Palestine, Tex., was announced in the *Railway Age* of May 27 (page 1252), was born at Thornton, Tex., on June 15, 1884, and was educated at the Texas Christian University and the Chicago Correspondence School of Law, from which he graduated in 1909. He entered railway service on June 4, 1904, as a clerk to the roadmaster on the International & Great Northern, and his entire railway career has been spent in the service of that company. In November, 1904, he became a stenographer in the office of the superintendent, and two years later was made chief clerk to the superintendent of the Fort Worth division. He served in this position until May 1, 1919, when he was appointed traveling wage supervisor. At the time of his recent promotion, Mr. Procter was serving as assistant to the general manager, a position to which he had been promoted in September, 1920.

E. Bodamer, whose promotion to superintendent of the Memphis terminal division of the Yazoo & Mississippi Valley, with headquarters at Memphis, Tenn., was announced in the *Railway Age* of June 10 (page 1378), was born at Logan, Ohio, on June 9, 1870, and first entered railroad service as a switchman on the Pennsylvania. In 1889, he became a switchman in the service of the Terminal Railroad Association at St. Louis, and in 1894, took service with the Wiggins Ferry Company of St. Louis. After serving as a conductor on the St. Louis-San Francisco, from 1899 to 1903, Mr. Bodamen became a conductor on the Illinois Central. He was promoted to trainmaster, with headquarters at Memphis, in 1913, and five years later was transferred to the Tennessee division. During the war he served as superintendent of the Memphis terminal division succeeding J. M. Walsh, and upon the latter's return from military service, he returned to his position as trainmaster. He was serving in this capacity at the time of his recent promotion.

Traffic

E. E. Overton has been appointed traffic manager of the Midland Continental, with headquarters at Jamestown, N. D.

A. L. Preston has been appointed general agent, freight department, of the Canadian Pacific with headquarters at New York.

Charles J. Rieger has been appointed express traffic agent of the Louisville & Nashville, with headquarters at Louisville, Ky., effective June 15.

G. S. Donaldson, traveling agent of the Chicago & North Western, with headquarters at Toronto, Ont., has been promoted to general agent, with the same headquarters, effective June 7, succeeding B. H. Bennett, deceased.

J. H. Shaw, general freight and passenger agent of the Arkansas & Louisiana Missouri, will also serve the Mansfield Railway & Transportation and the Louisiana & Pine Bluff in a similar capacity with headquarters at Shreveport, La., effective June 1.

A. L. Eidenmiller, general agent of the Chicago, Milwaukee & St. Paul, with headquarters at Boston, Mass., has been appointed general advertising agent, with headquarters at Chicago. **F. D. Dodge** succeeds Mr. Eidenmiller. The appointments were effective June 15.

P. Schorr, traveling freight agent of the Wabash, with headquarters at Des Moines, Iowa, has been promoted to division freight agent, with the same headquarters. Mr. Schorr succeeds **L. E. Clarahan,** who has been transferred to Omaha, Neb., succeeding G. M. Entrikin, deceased. The promotion and changes were effective June 15.

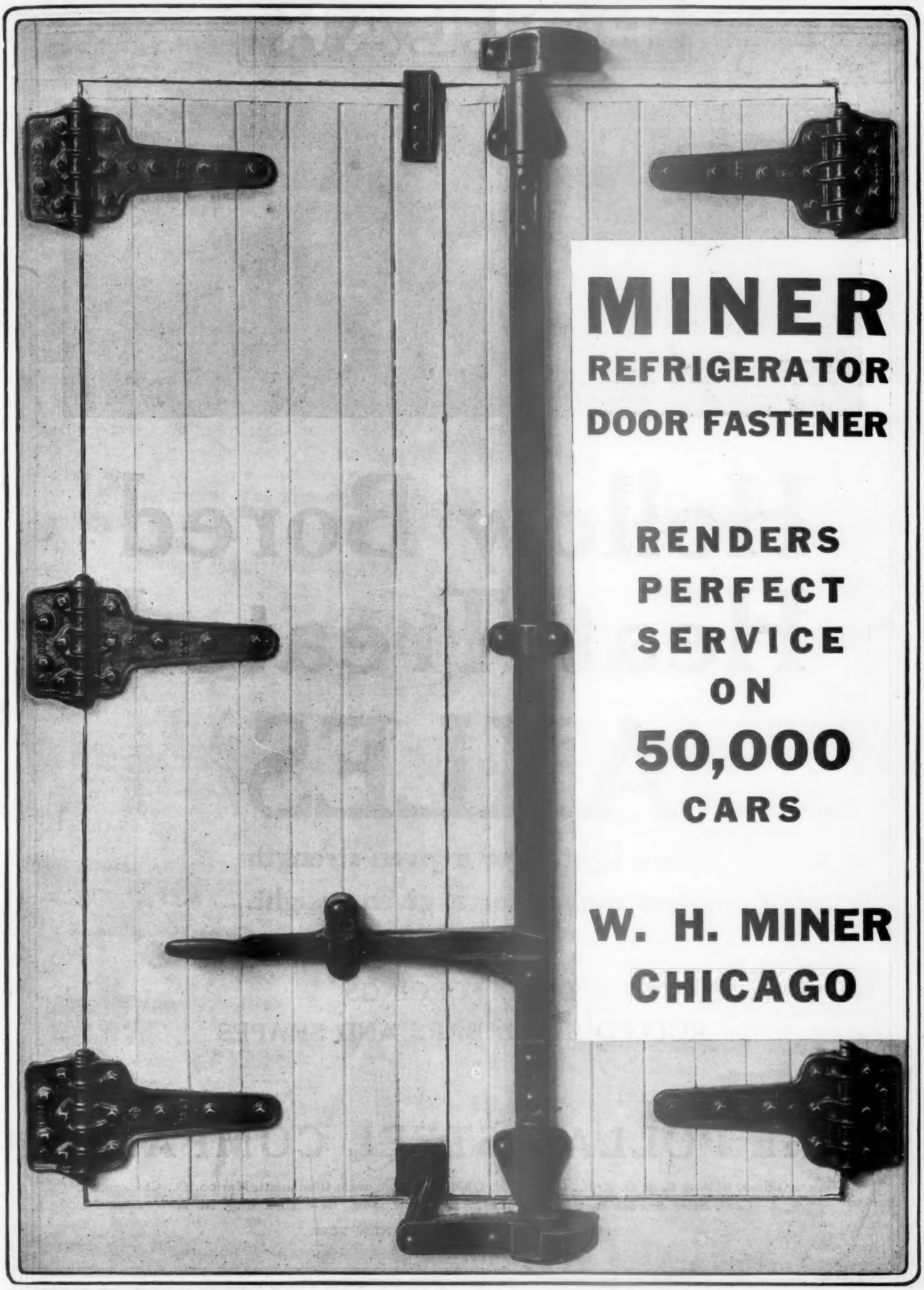
H. W. Watson, commercial agent of the Georgia & Florida, with headquarters at Nashville, Tenn., has been promoted to general freight and passenger agent, with headquarters at Augusta, Ga., succeeding W. D. Cook, who has resigned. **W. W. Swain** succeeds Mr. Watson. **D. W. Agnew** has been appointed general western agent, with headquarters at Cincinnati, Ohio, and **W. H. L. Nelms** has been appointed general agent, with headquarters at Atlanta, Ga.

Obituary

Coleman King, supervisor of track of the Long Island, died in St. Catherine's Hospital, Brooklyn, N. Y., on June 18, at the age of 59. Mr. King was a past-president of the Roadmasters and Maintenance of Way Association of the United States.

William H. Given, at one time assistant general manager of the Waterloo, Cedar Falls & Northern and more recently train rules examiner of the Chicago, Rock Island & Pacific, first district, died at Iowa City, Ia., on June 7, at the age of 63. Mr. Given was born at Coshocton, O., and at the age of seventeen entered the service of the Des Moines Valley, which was later absorbed by the Rock Island. He became trainmaster, and later superintendent, of the Missouri, Iowa & Des Moines Valley. For a short time he was assistant general manager of the Waterloo, Cedar Falls & Northern and in 1917 he returned to the Rock Island as train rules examiner, which position he held at the time of his death.

PENNSYLVANIA RAILROAD STOCKHOLDERS numbered 140,159 on May 1, an increase of 1,766 since April 1, and of 16,272 since May 1, 1920.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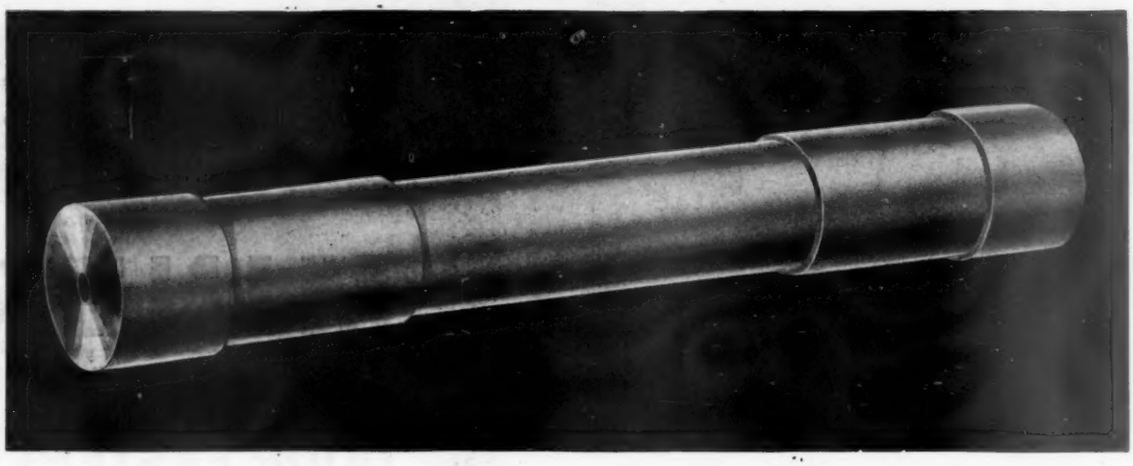

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Railway Age

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Suburban Trains Leaving Erie Terminal at Jersey City. Photo by Ewing Galloway

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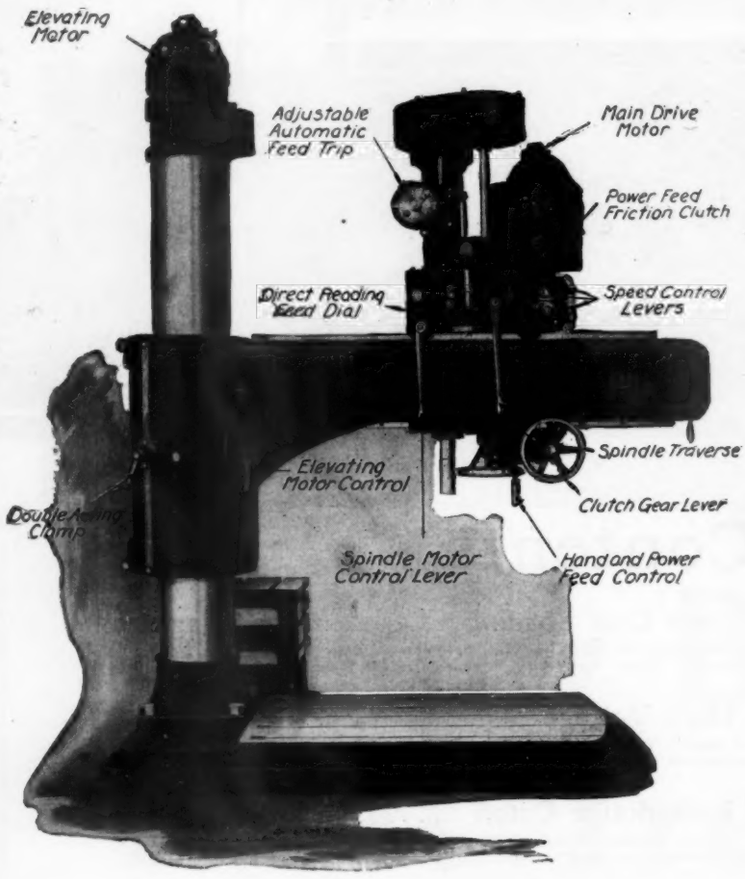

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BACK STOP
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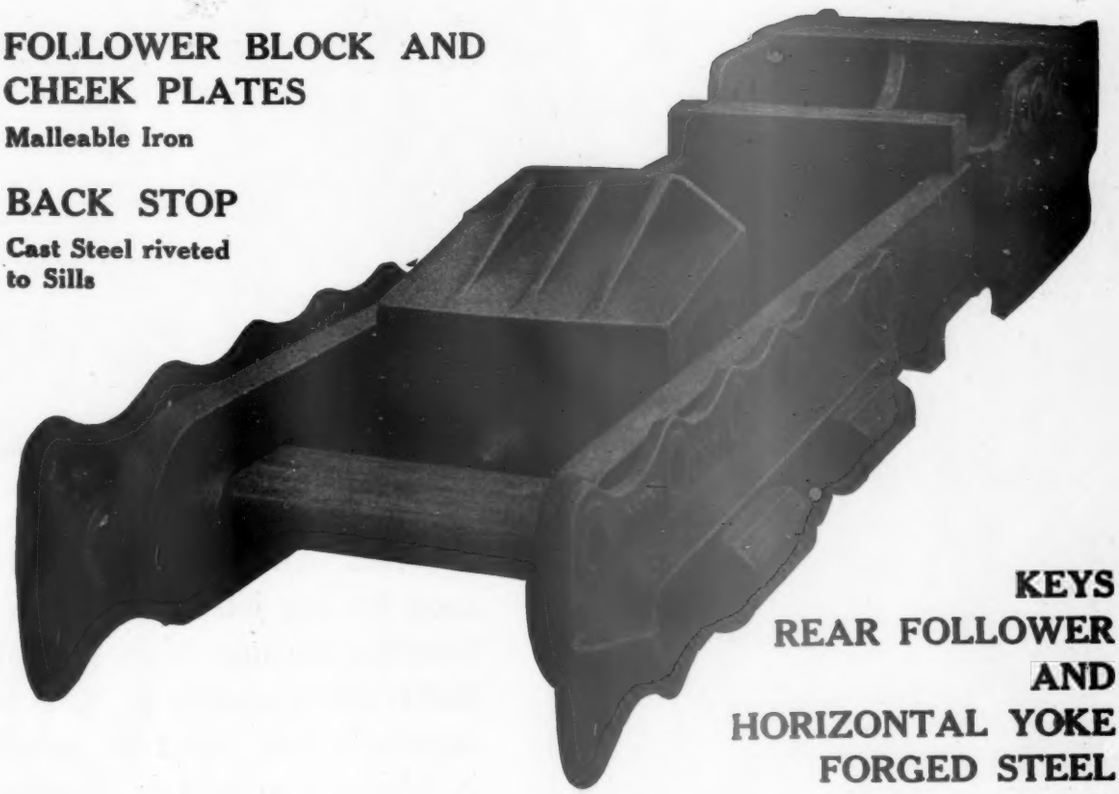
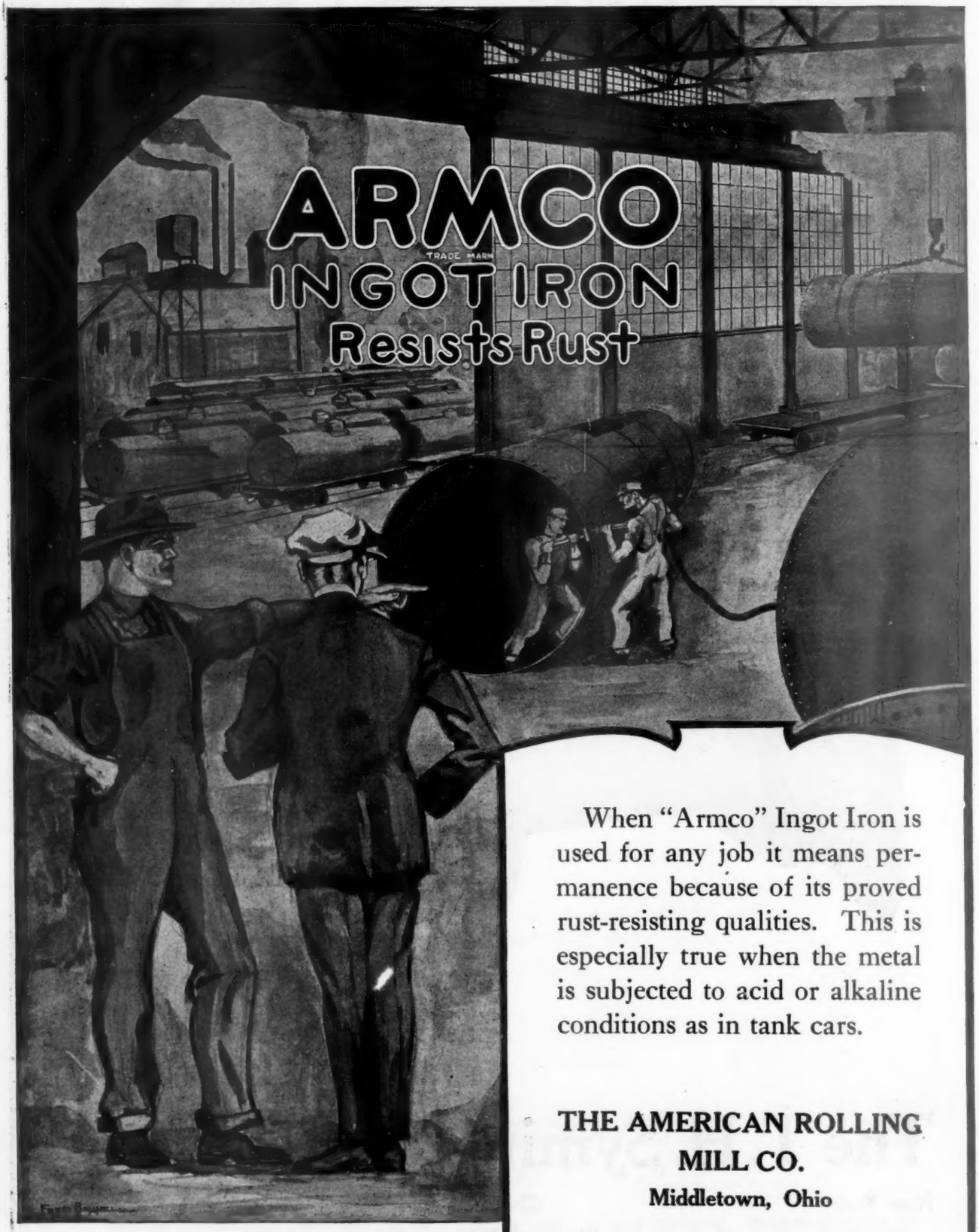


KEYS
REAR FOLLOWER AND HORIZONTAL YOKE
FORGED STEEL

The T. H. Symington Company

New York Chicago Baltimore

Works at Rochester

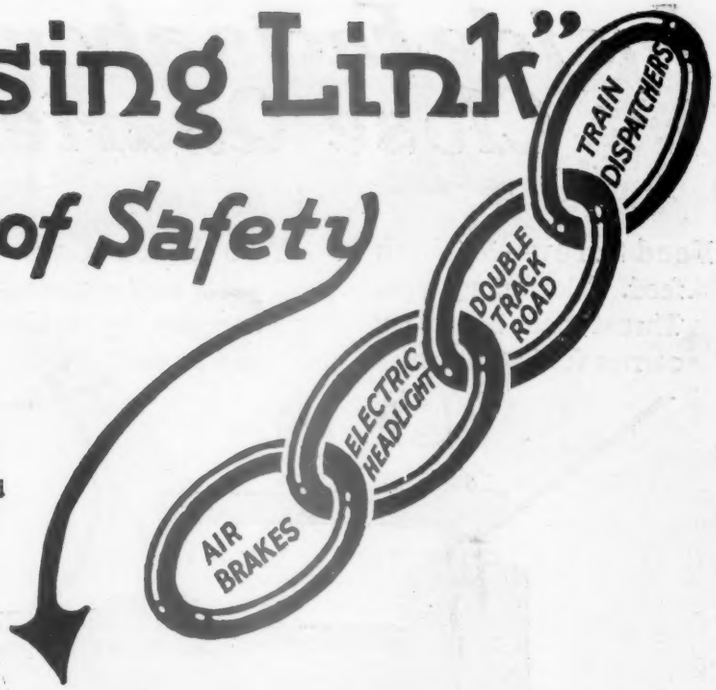


When "Armco" Ingot Iron is used for any job it means permanence because of its proved rust-resisting qualities. This is especially true when the metal is subjected to acid or alkaline conditions as in tank cars.

THE AMERICAN ROLLING MILL CO.

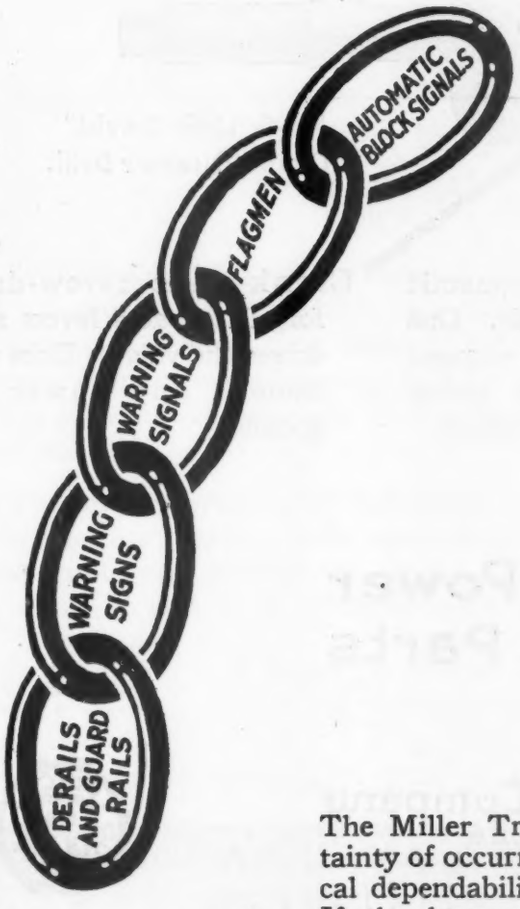
Middletown, Ohio

"The Missing Link" in the Chain of Safety



SEQUENCE OF EVENTS

between an obstruction on the track and the stopping of a train



MECHANICAL

1. A metallic path is established between opposite rails of the track circuit.
2. A sufficient portion of the track current flows through this shunt to reduce the amount of current through the coils of the track relay below the minimum required to hold its armature attracted.
3. The control circuits of the signals open at the contacts of the de-energized track relay.
4. The line control circuits are de-energized.
5. The slot or holding clear magnets of the signal become de-energized.
6. The mechanical latch or other hold-clear mechanism of the signal releases.
7. The signal arm, under the action of the gravity, assumes the stop position, displaying the stop signal indication.

HUMAN

8. The engineman sees the signal.
9. The engineman senses and interprets its indication.
10. He decides to stop his train.
11. He shuts off the power.
12. He manipulates the air-brake valve handle.

MECHANICAL

13. An outlet for air-brake pressure to atmosphere is established.
14. The train line air pressure falls.
15. The triple valve operates.
16. Reservoir air is admitted to the brake cylinders.
17. The brake piston, rigging and beams operate to cause application of the brake shoes to the wheels.
18. The energy of motion of the train is converted into heat and the train retarded and finally stopped.

The Miller Train Control substitutes for the uncertainty of occurrence of items 8 to 12 the same mechanical dependability that characterizes the other events. If the human element does not function, it does.

STAUNTON, VA. **Miller Train Control** DANVILLE, ILL.

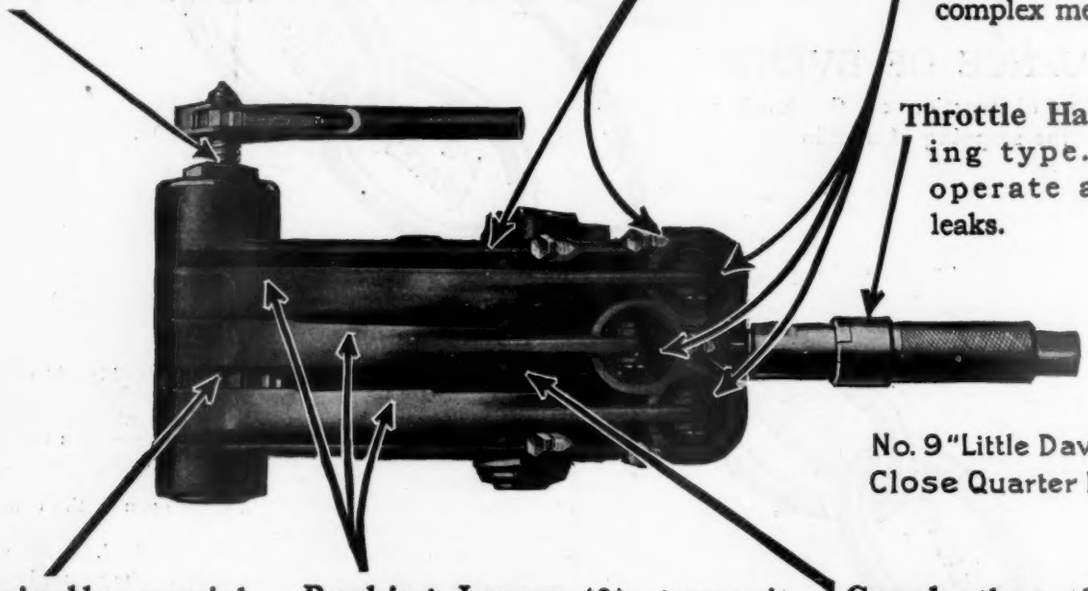
Inside Facts about "Little David" Close Quarter Air Drills

Feed Screw—3¾-inch feed. Telescoping type. Thrust ball bearing carries feed pressure.

Two Piece Case—working parts easily accessible for inspection by taking out few cap screws.

Three Pistons—which apply power direct to rocking levers. No intermediate gears or complex mechanism.

Throttle Handle—rolling type. Easy to operate and no air leaks.



No. 9 "Little David" Close Quarter Drill.

Spindle—special steel and heat treatment. Very strong—made in one piece.

Rocking Levers (3)—transmit power directly to spindle. One ratchet pawl is always engaged with a tooth of spindle giving very steady spindle movement.

Crank—three throw-drop forged. Spaces levers and drives the valve. Does not transmit any power to spindle.

50% More Power 50% Less Parts

Catalog 8000 describes "Little David" Air Tools

Ingersoll-Rand Company
General Offices
11 Broadway, New York

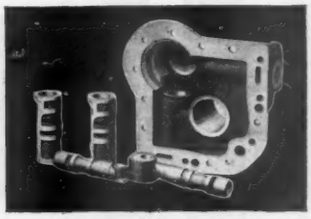
PRICE AR OIL ENGINES

Ingersoll-Rand

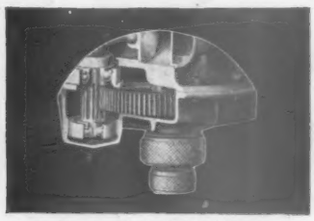
Air Drills, Chipping and Riveting Hammers, Air Motor Hoists.

THE "BIG FOUR" REASONS WHY LITTLE GIANTS ARE THE WORLD'S STANDARD AIR DRILL

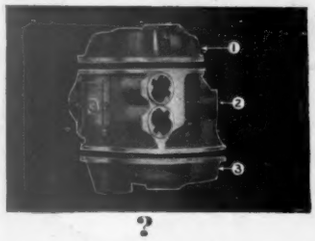
3-Point Crankshaft Suspension



Balanced Piston Valves



Sturdy Stub-Tooth Gears



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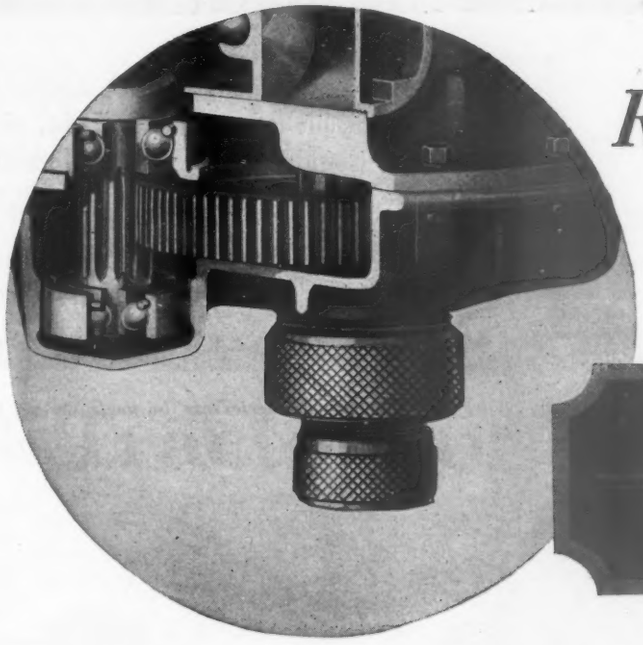


Reason No. 3

Every need of drilling, wood-boring, reaming, tapping, and screw-setting operations is met by a wide variety of sizes and types of Little Giant Air Drills obtainable from Branch stocks. Address nearest Branch for Bulletin 598.

Little Giant No. 2 Air Drill
Non-Reversible Type

WHEN you think of the thousands of Little Giant Air Drills in year-in and year-out service, and their complete freedom from gear stripping and other driving gear difficulties, you're curious to know why.

The reason is—practically indestructible, sturdy *stub-tooth* gears, with teeth thicker at the roots and shorter in length, and thus stronger and more compact than the commonly used involute type. Result—no gear stripping; no crankshaft renewals; no unserviceable drills awaiting dismantling for crankshaft and gear replacements.

With the *users'* interests at heart, automotive engineers were quick to utilize the superior strength and dependability of stub-tooth gears. So were the engineers responsible for the World's Standard Air Drill.

Chicago Pneumatic Tool Company

Chicago Pneumatic Building • 6 East 44th Street • New York

*Sales and *Service Branches all over the World*

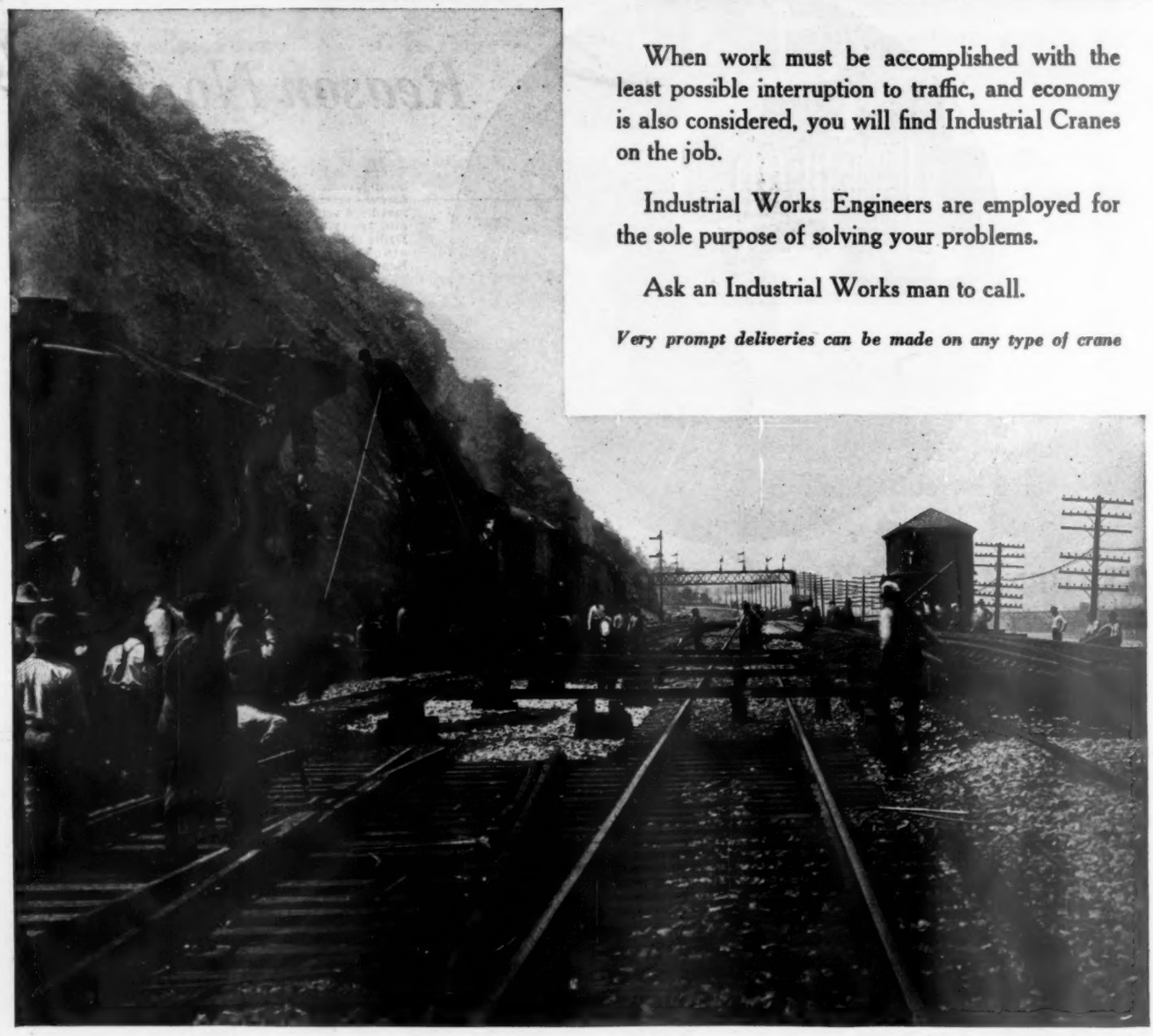
*Birmingham	*Chicago	*Detroit	Franklin	*Los Angeles	*New York	Richmond	*Seattle	Basle	Brussels	Copenhagen	Helsingfors	*London	Montevideo	Paris		Santiago	Shanghai	Toronto
*Boston	*Cincinnati	El Paso	Houston	*Minneapolis	*Philadelphia	Salt Lake City	*St. Louis	*Berlin	Buenos Aires	*Fraserburgh	Honolulu	Manila	*Montreal	Rio de Janiro		Sao Paulo	Tientsin	Vancouver
*Buffalo	*Cleveland	Erie	Joplin	*New Orleans	*Pittsburgh	*San Francisco		Bombay	Christiania	Havana	Johannesburg	Milan	Osaka	*Rotterdam		Seoul	Tokyo	Winnipeg

P-118

BOYER PNEUMATIC HAMMERS··LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
CHICAGO PNEUMATIC AIR COMPRESSORS··VACUUM PUMPS··PNEUMATIC HOISTS
GIANT OIL AND GAS ENGINES ROCK DRILLS ·· COAL DRILLS

LITTLE *The World's Standard* GIANT *Air Drill*

INDUSTRIAL CRANES



When work must be accomplished with the least possible interruption to traffic, and economy is also considered, you will find Industrial Cranes on the job.

Industrial Works Engineers are employed for the sole purpose of solving your problems.

Ask an Industrial Works man to call.

Very prompt deliveries can be made on any type of crane

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C. B. Davis Engineering Co., Birmingham, Ala.; J. G. Miller, St. Louis, Mo.; F. H. Hopkins & Co., Montreal, Que.; N. B. Livermore & Co., San Francisco, Cal.; Northwestern Equipment Co., Portland, Ore., and Seattle, Wash.

Locomotive, Erection and Wrecking Cranes, 5 to 160 tons capacity. Pile Drivers, Pillar Cranes, Transfer Cranes, Rail Saws

Whiting Turntable Tractor in service at Pere Marquette Railroad Shops, Saginaw, Michigan.

A Tractor for Heavy Duty

The Whiting Turntable Tractor is a simple rugged design built to stand up under most severe service.

Whiting Tractors are delivered completely assembled even to the wiring, saving time and money when installing.

Specifications on request.

WHITING *Corporation*

(Formerly Whiting Foundry Equipment Co.)

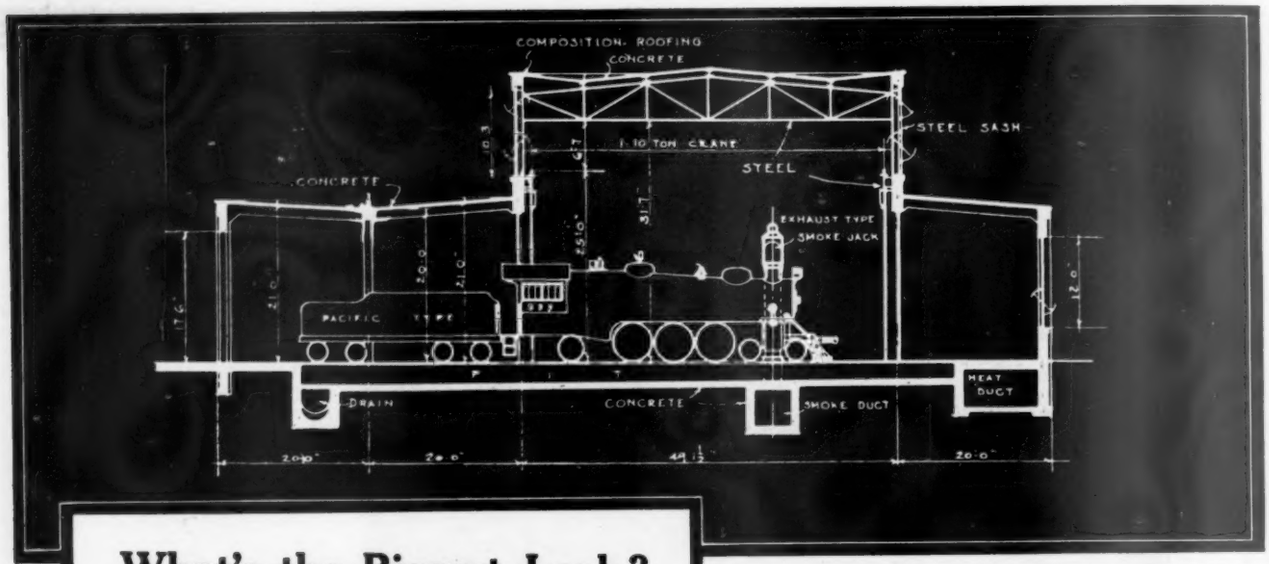
General Office & Works: Harvey, Ill.
(Chicago Suburb)

Representatives in 25 Principal Cities

All machinery is located underneath cab floor, enclosed on all sides in sheet steel housing, which has been removed in this cut to show machinery. Sliding doors give ready access for inspection and repair.

Send for Railway Equipment Catalog No. 145.

WHITING CRANES
FOUNDRY EQUIPMENT
RAILWAY SPECIALTIES



What's the Biggest Leak?

PRESENT inadequate and antiquated terminals are probably the greatest obstacles to increasing the capacity and net revenue of most roads. Even under present conditions, new construction is necessary in the interest of decreased operating expenses.

More cars and power available for road movement resulting from adequate terminals will be necessary for the maximum business which is coming—modern and adequate terminals will stop the biggest leak now. Improve your terminals and increase revenue service—present and future.

Engine Terminal Talks--

By EXUM M. HAAS

Avoid Unforeseen Expenses

COMPUTING present terminal values or stating guaranteed amounts for the cost of any new construction is a service which we render with authoritative care. We have seen too many ventures shipwrecked because construction and equipment have far exceeded the advance estimates and so do not risk hasty judgment.

Personally, we are always ready to give responsible estimates for total costs and fix a *guaranteed* lump sum for the design, construction and equipment of engine terminals, locomotive, car repair and machine shops. A problem placed in the hands of our Railroad Department will be handled with full understanding of the peculiar difficulties you face in your daily operation.

Send us your floor plans and a cross-section so that we can show you how to save at least 25% on your locomotive erecting shop by the use of the Gap-Crane.

FERGUSON ORIGINATED STANDARD FACTORIES

THE H. K. FERGUSON CO.

Engineers and Builders

HAROLD K. FERGUSON, Pres.

Railroad Department, EXUM M. HAAS, Mgr.

6523 Euclid Avenue Phone Randolph 6854 CLEVELAND, O.

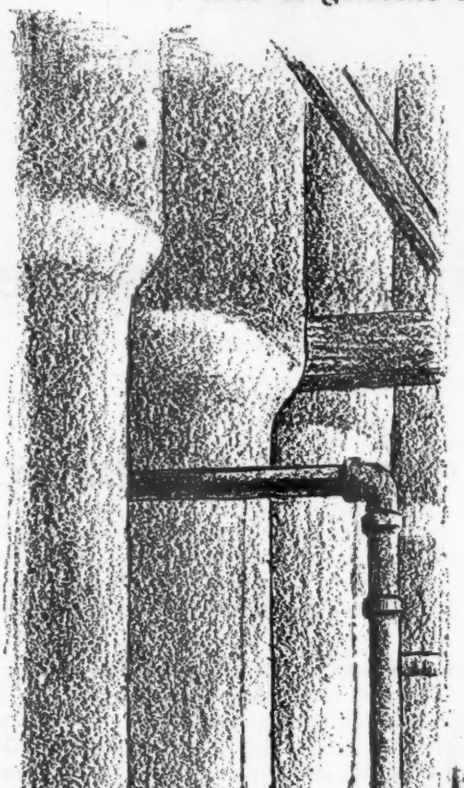
Ferguson

RAILROAD BUILDINGS

LOCOMOTIVE PARTS

MIDVALE BOILER TUBES

Made of genuine old-fashioned knobbled charcoal iron



GENUINE charcoal iron made by the old-fashioned knobbling process is still recognized as the best material for boiler tubes because of its long life and superior resistance to corrosion and crystallization.

All Midvale iron boiler tubes are made from this superior material and will be found to give unusually good service.

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CAMBRIA STEEL COMPANY

General Sales Office:

WIDENER BUILDING, PHILADELPHIA, PA.

DISTRICT SALES OFFICES:

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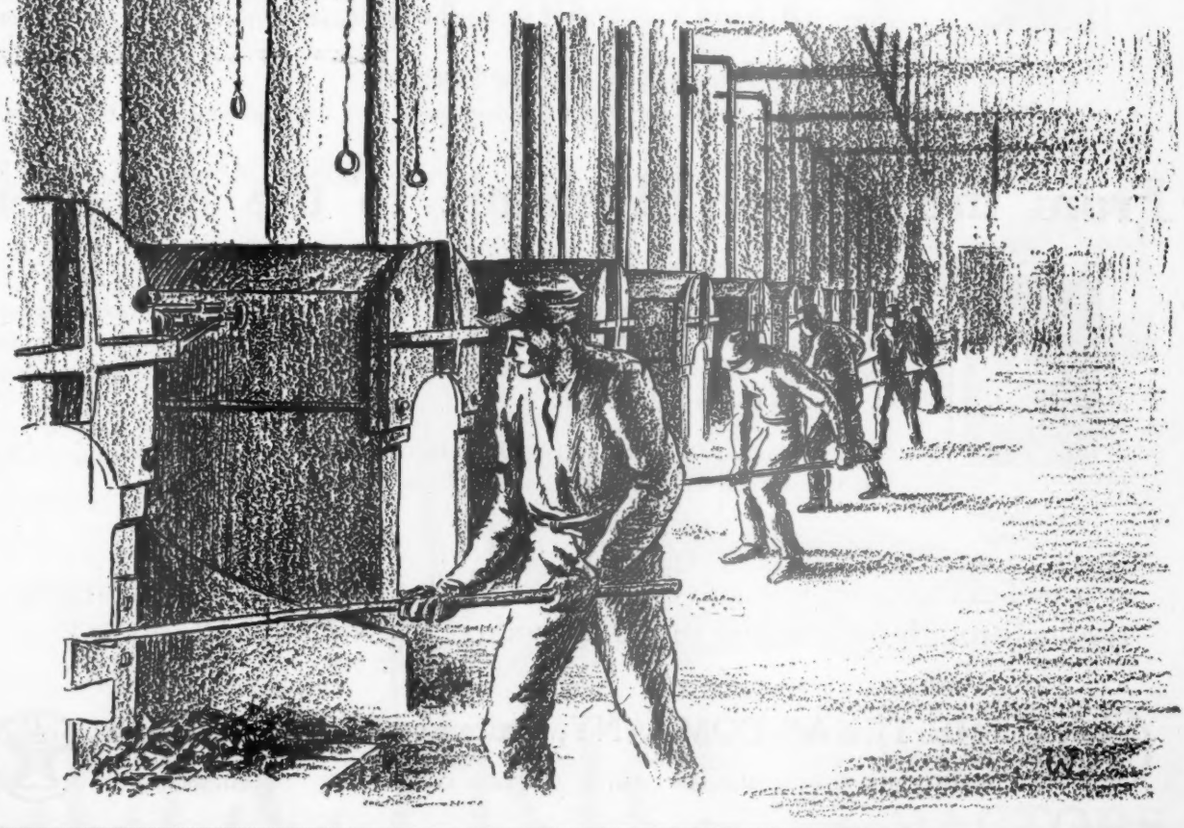
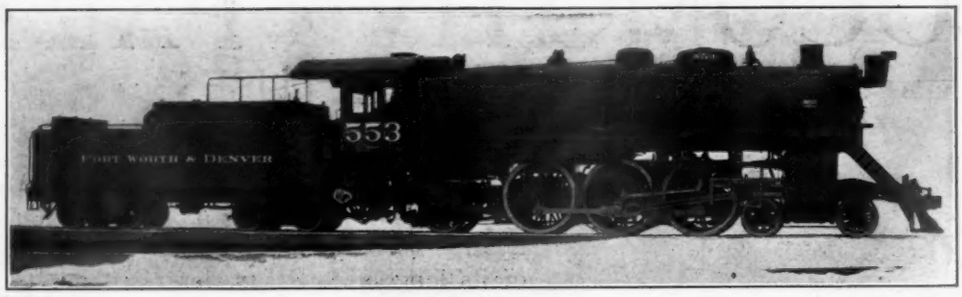
SOLE EXPORTER OF OUR COMMERCIAL PRODUCTS CONSTECO CONSOLIDATED STEEL CORPORATION 25 BROADWAY, NEW YORK, U.S.A.





The Locomotive

Two letters and their significance

exchanged between Master Mechanic and Engineer on a prominent Railway in the Southwestern Territory

From the Engineer to the Master Mechanic

The Engineer

"Having heard much recently concerning record made by Valve Oil based on number of miles run per pint, under strict test conditions and expert supervision, I am calling your attention to record made in every day practice by one of our New Pacific Type Passenger Engines (553) assigned to 220 mile Passenger Service Run, with schedule of eight hours between Terminals.

"This Engine, while in my charge, March, 1920, to this date consumed an average of 2½ pints of Valve Oil, or an average of 88 miles to the pint, in making the run of 220 miles. It is my understanding that the cylinder heads of this Engine have not to this date been removed, notwithstanding the Engine has run approximately 80,000 miles. This record made without test conditions or extra supervision, in my opinion, indicates two things:

"(1) A first class Engine in every particular.

"(2) A first class Lubricating Oil that meets fully the requirements of the service."

From the Master Mechanic to the Engineer

The Master Mechanic

"Your favor as of April 15th:"

"Individual and initiative effort are essential in obtaining beneficial results in any line of endeavor. You have proven yourself equal to the emergency in every day practice and this is to thank you for the economical results obtained in the use of Lubricating Oil on your Engine.

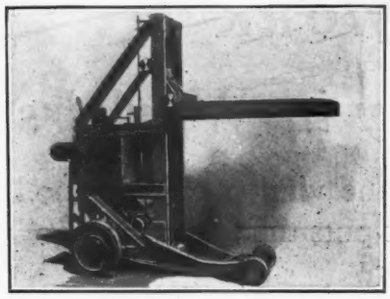
"You are correct in your understanding, the records indicating that this Engine has run 85,288 miles without renewal of cylinder or valve packing rings."

It was Texaco superheat valve oil that assisted the engineer in obtaining results through the exercise of his individual and initiative effort.

THE TEXAS COMPANY, Railway Sales Department

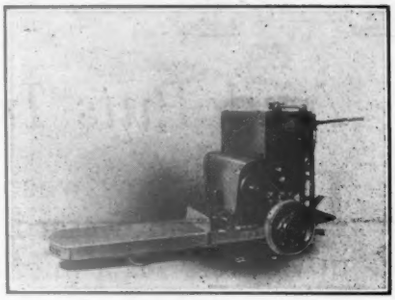
NEW YORK Whitehall Bldg. | CHICAGO McCormick Bldg. | HOUSTON The Texas Company Bldg. | ATLANTA Healy Building

"Automatics"



Tiering-Lifting Truck

Type "T" Tractor



Type "L" Lifting Truck

You will soon be buying

TRUCKS AND TRACTORS

For Shops, Terminals,
Stores, Round-Houses, Etc.

It will pay you to investigate

"AUTOMATICS"

Quality and Service

WRITE FOR CATALOGUE

TRANSPORTATION ENGINEERING CORPORATION

200 Fifth Avenue, New York City
608 So. Dearborn St., Chicago, Ill.

Exclusive Railroad Distributors for:

THE AUTOMATIC TRANSPORTATION CO.
Buffalo, N. Y.

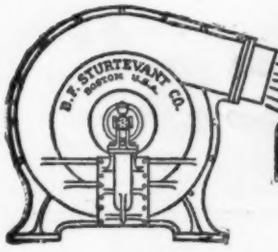
Pioneer and World's largest manufacturer of storage battery industrial trucks, and tractors for all purposes.

Watch subsequent issues for other "AUTOMATIC" railroad models.

BY INVITATION MEMBER OF

3,000-lb. Crane Truck

ELECTRIC TRUCKS TRACTORS



Sturtevant

REG. U.S. PAT. OFF.

PUTS AIR TO WORK

And Puts Increased Energy in Workers

RIGHT now when increased production is the vital problem, good fresh air, washed, heated or cooled—air that puts the "snap and go" in workers—is a mighty big factor in its solution.

Clean, pure air for workers in railway shops, foundries, roundhouses, paint shops, car shops and tunnels—think of the added efficiency. But no! Don't think of it—have it by means of

Sturtevant (REG. U. S. PAT. OFF.)

HEATING AND VENTILATING SYSTEMS

Take your roundhouses for example—think of the increased power your road secures through adequate roundhouse facilities, and then reflect on the increased power your road will secure through furnishing roundhouse workers an abundant supply of clear, dry air delivered to them by Sturtevant Fans.

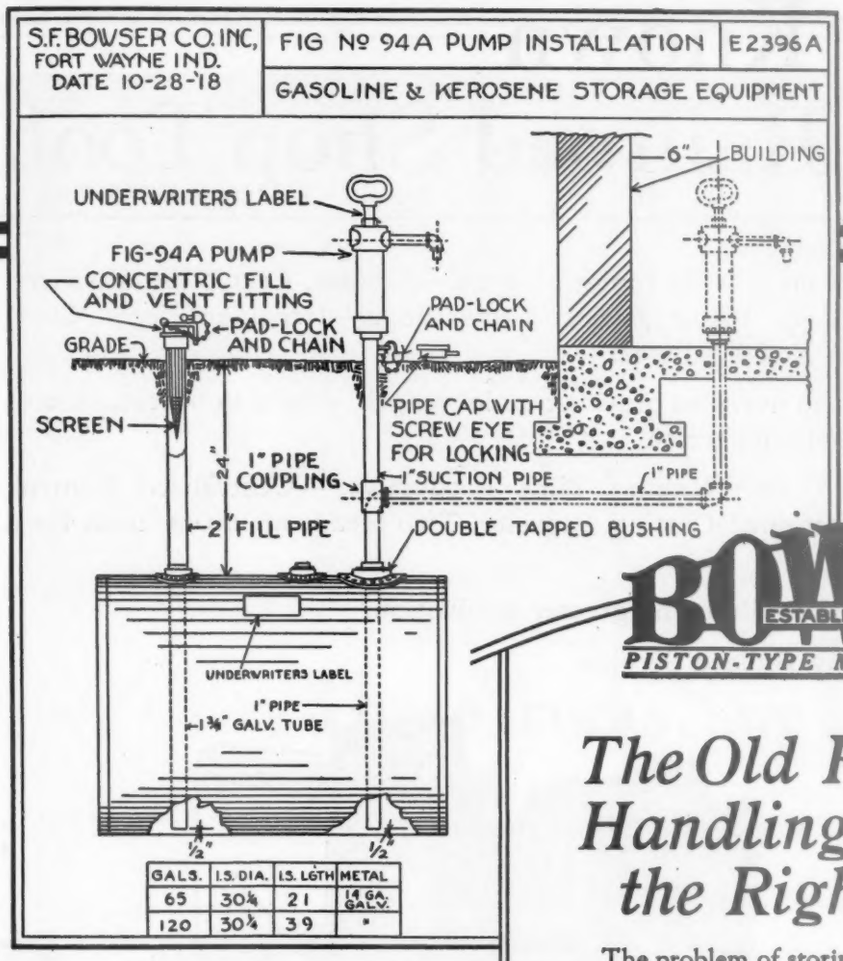
Don't forget, too, that comfortable shops have a direct bearing on your labor problem by making workers contented, and that Sturtevant Systems are bringing comfort to workers and economy to operation on practically every railway in the United States and Canada.

Know why a Sturtevant System is a dividend payer. Send for catalog 1010, *the book which points the way to better work and more of it.*

B. F. STURTEVANT COMPANY

HYDE PARK, AND ALL PRINCIPAL CITIES BOSTON, MASS.

Fifty-eight-Stall Roundhouse on the Chicago & North Western, Sturtevant Equipped.



Write for Illustrated Booklet A-25

BOWSER
ESTABLISHED 1885
PISTON-TYPE MEASURING PUMP

The Old Reliable for Handling Oils Along the Right-of-Way

The problem of storing and handling oils along the right-of-way has been solved for many years by the Bowser Fig. 94-A Equipment.

This unit is practically standard on some of the largest railroad systems in America—many have several hundred in use.

The Bowser Fig. 94-A is the ideal equipment for storing and handling gasoline and burning oils, making a convenient supply at section headquarters, signal stations and other places where barrel storage is ordinarily used.

Bowser Equipment eliminates fire hazard and makes oil and gasoline conveniently available in any desired quantity.

When not in use, the pump is quickly detached from the suction pipe, which is covered with a lock cap. Or the pump may be locked while still connected. This renders the Equipment absolutely thief-proof.

S. F. Bowser & Co., Inc.

1325 Creighton Avenue Ft. Wayne, Ind.

Sales Offices (with Service Departments) throughout the United States and in Principal Cities of the World.

S. F. Bowser & Co. of Texas, Dallas. S. F. Bowser Co., Ltd., Toronto.

"The Best Known Railroad Shop Tool."

Economical production on a wide range of work,—Brasses, Crank Pin Washers, Pump Rings,—Cylinder Heads, Piston Bands, Valve Rings,—Irregular Pieces, Cross Heads, Truck Centres, Side Rod Bushings.

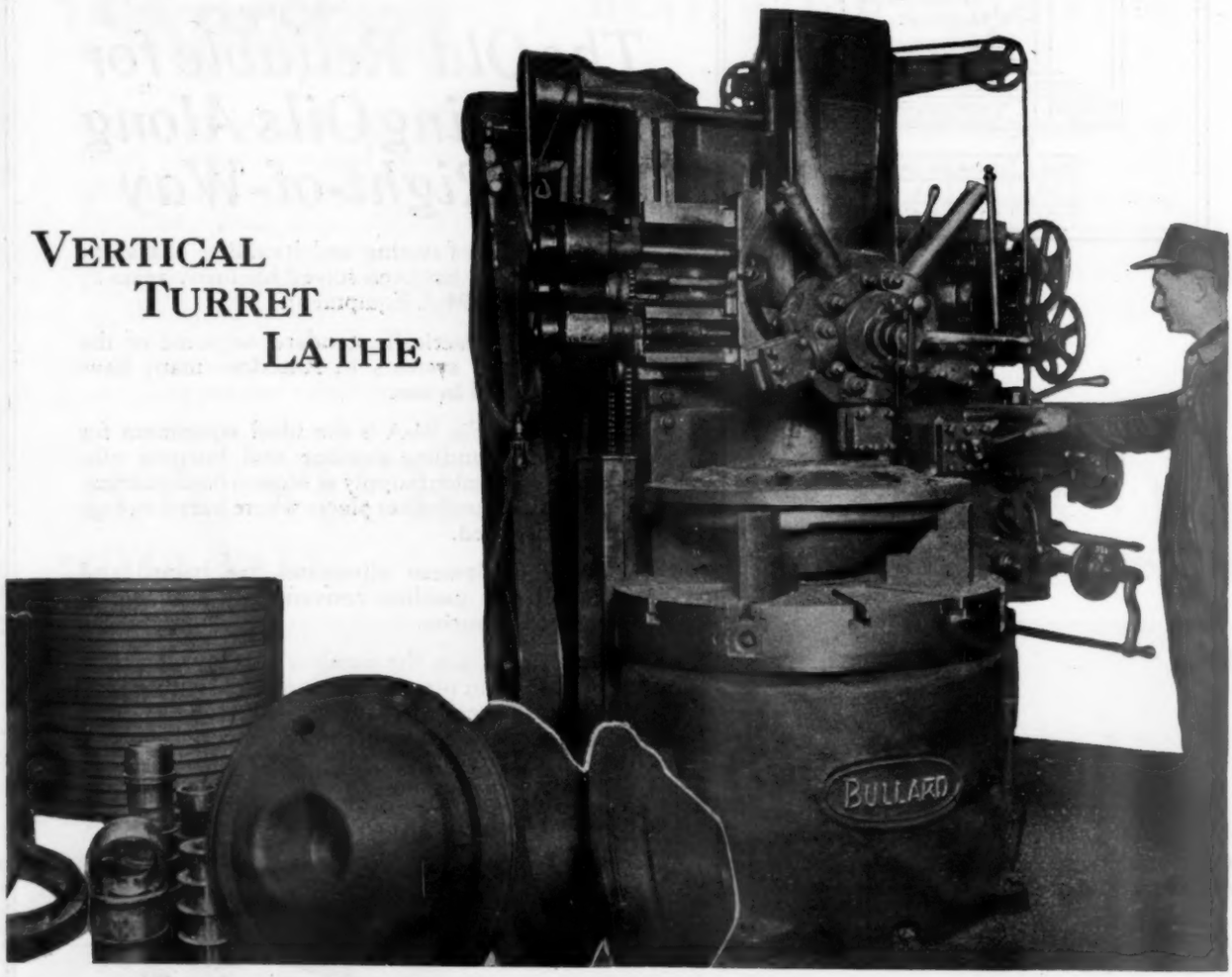
A rugged machine with an overplus of power and strength, simple in operation, economical in production, durable in service.

Operation concentrated on "Making Time Productive,"—Centralized Control, simple and convenient,—Multiplied Cutting Capacity, Two Heads mounting tools for a sequence of operations.

Low operating cost further diluted by greater production.

Backed clear through by Bullard Service.

VERTICAL TURRET LATHE



THE BULLARD MACHINE TOOL CO.

BRIDGEPORT, CONNECTICUT

These Trucks Save $7984 A Year

1000 HYATT EQUIPPED TRUCKS SPEED UP THE WORK AND CUT LUBRICATION COSTS 88% FOR THE NEW YORK DOCK COMPANY.

Three years ago this company replaced their old-fashioned, plain bearing trucks with one thousand Hyatt equipped trucks.

When they struggled along with plain bearing trucks, one man spent all of his time oiling trucks, using 7,800 gallons of oil every year. Figuring labor at $4.00 per day for 300 days cost $1,200—oil at $1.00 per gallon cost $7,800—lubrication cost for plain bearing trucks, $9,000 per year.

When the easy running Hyatt bearing trucks came on the job, the former oiler got a job pushing a truck, as Hyatt bearings only need oil once every 3 months, and only 1,000 gallons of oil were required per year.

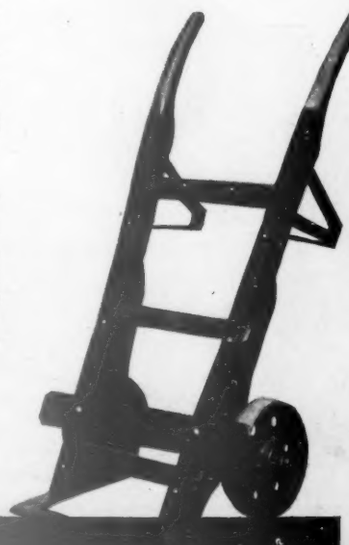
Labor now cost per year—4 days at $4.00 = $16.00—oil cost $1,000—lubrication cost for Hyatt bearing trucks per year, $1,016.

Saving in lubrication cost (labor and oil) made by Hyatt bearing trucks amounts to $9,000 — $1,016 = $7,984 = 88.7%.

This real saving in lubrication, in addition to the easy running and durable qualities of Hyatt bearing trucks, should prove that you can no longer afford to use plain bearing trucks.

Specify Hyatt bearing trucks on your next order or ask us about applying them to your present trucks.

Hyatt Roller Bearing Company, New York, N. Y.



One of the 1,000 Hyatt equipped trucks made and used by the New York Dock Company, Brooklyn, N. Y.

EXPLOSIVES ~ SERVICE

NOTABLE IMPROVEMENTS

in the Transportation and Storage of Explosives That SAVE LIVES and Dollars

IT is the constant aim of this Company not only to improve the efficiency of explosives, but to safeguard their transportation and storage so as to minimize all hazards.

That our work along these lines has been successful is evidenced by the fact that during the year 1919 the Bureau for the Safe Transportation of Explosives and other Dangerous Articles reported that there was no loss of life nor property resulting from the lawful transportation of commercial explosives in the United States.

Du Pont Explosives Service covers every possible phase of the important business of developing, making, distributing and using explosives. The great Du Pont laboratories and plants with their highly trained staffs of chemists and technicians, a widespread, efficient distributing system and the practical services of expert field men are all at your command.

Put your explosives problems up to Du Pont.

E. I. du Pont de Nemours & Co., Inc.
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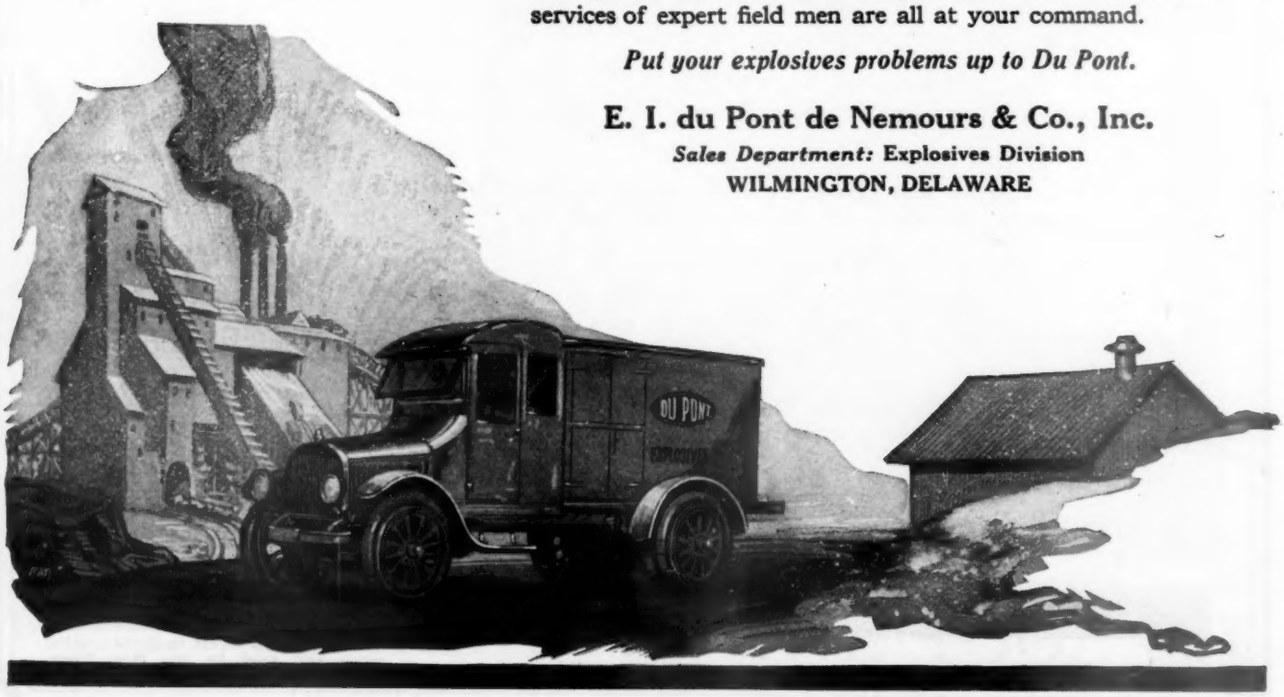
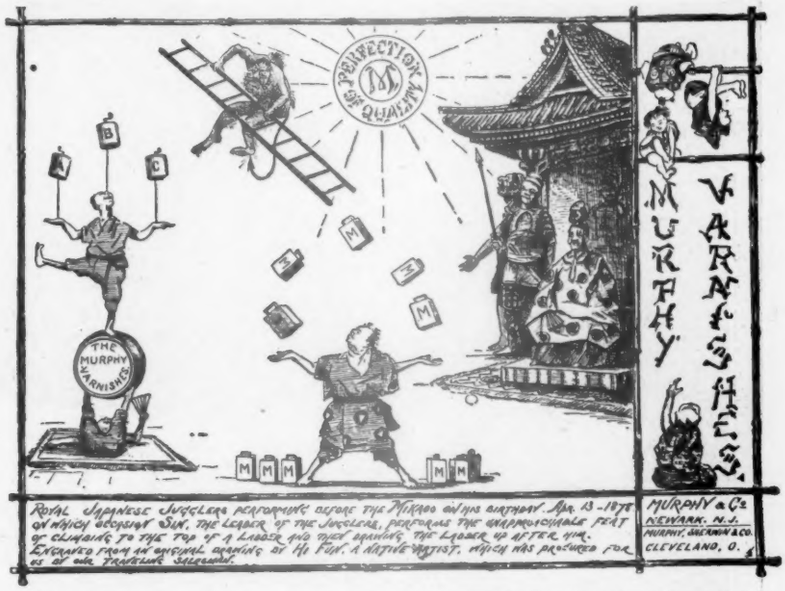
Du Pont Products Exhibit
Atlantic City, N. J.



Reflections on Varnish



This picture by Hi Fun, originally used in a Murphy Varnish advertisement of 1878, is of interest. But of even greater interest is the fact that the use of Murphy Varnish for preserving the finish of your cars will prove a decided factor in meeting the present high cost.

VARNISH always costs less than varnishing—much less today with labor cost what it is—and hence good varnish—always an economy—is a necessity today when the money value of the finish on a car is three times what it used to be.

Remember that when you finish your passenger cars with Murphy Perfect Railway Body Varnish, you have used that which authorized endurance tests on many important railways have proved, keeps cars out of the paint shop, and in fit condition for their job of earning revenue, for the longest period—at least six months, probably a year longer than cheaper varnishes. In fact,

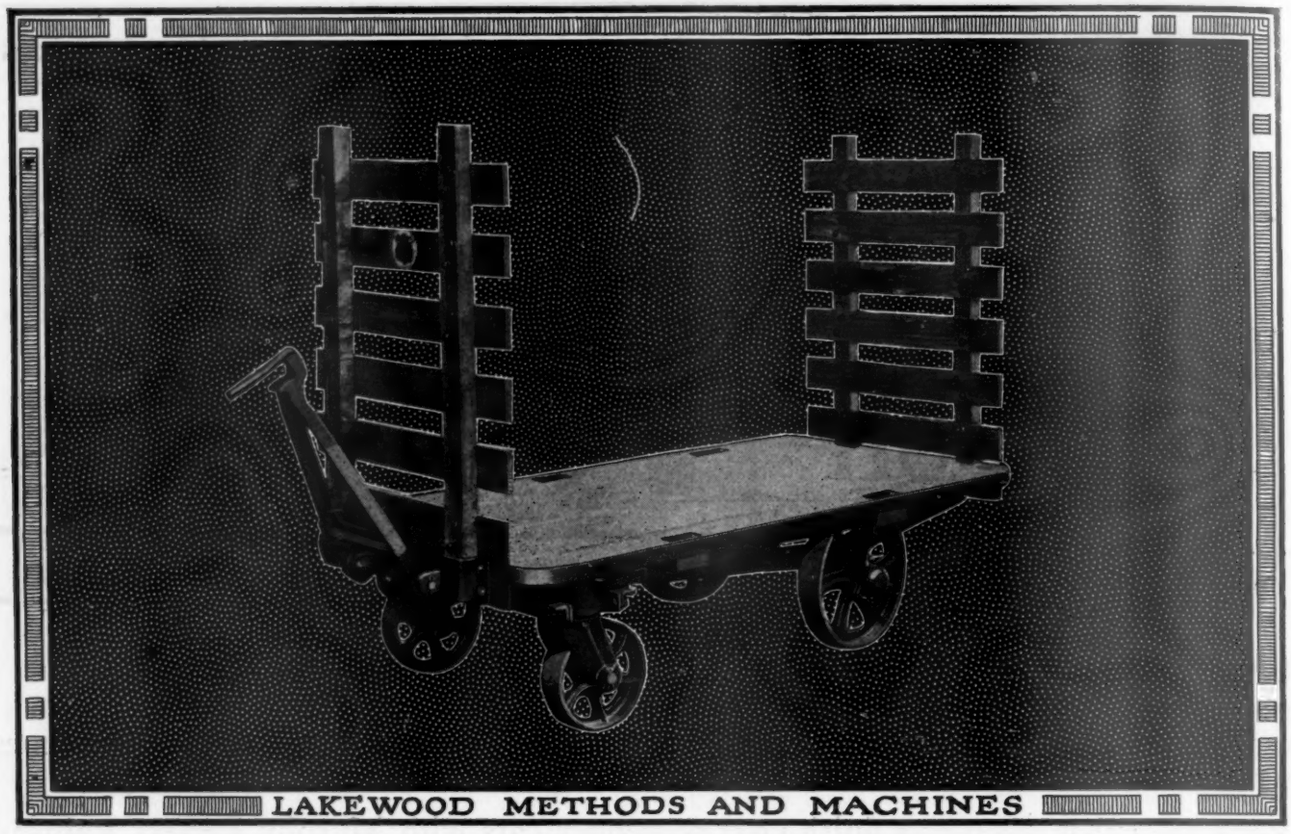
Murphy
Perfect Railway Body Varnish
the varnish that lasts longest

has proved its unequalled economy on many roads in terms of increased passenger earnings and decreased expense in the paint shop.

Reflect how for a half century and more, in every ingredient, in every detail of its manufacture, the constant aim of Murphy Varnish making has been *Quality*. Quality never lessened to meet competition, never departed from to the slightest degree—save that as the years have gone by, there has gone into Murphy Varnish that knowledge gained by experience and which has gained and kept for it the reputation of *the varnish that lasts longest.*

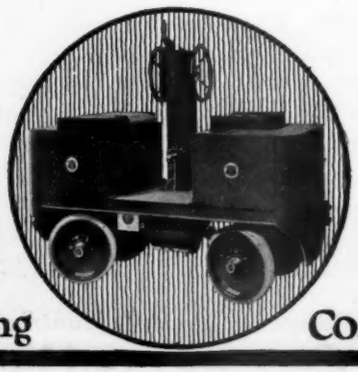
In short, Murphy varnish does two things—assures good appearance of cars for longer periods, and insures against their early reappearance in the paint shop, or in other words—adds to their earning capacity and deducts from their maintenance cost.

MURPHY VARNISH COMPANY
NEWARK CHICAGO
The Dougall Varnish Company, Limited, Montreal, Canadian Associates



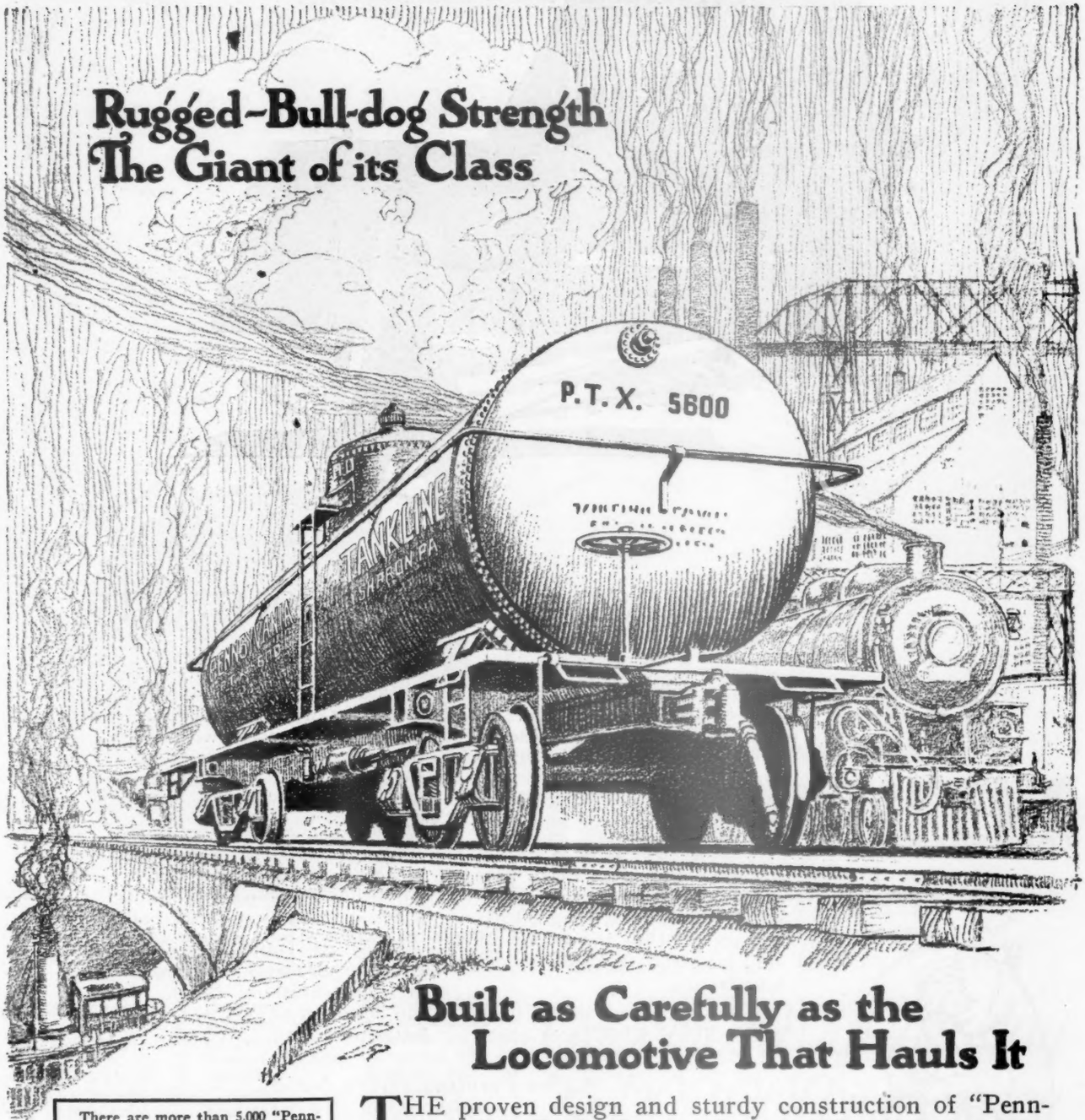
We Developed This Trailer for Railway Service

This Lakewood Trailer (Model 810) was developed by our engineers in co-operation with a big eastern railroad. It has been designed especially for use in railway terminals, piers and warehouses. This Lakewood railroad trailer is well suited for hand or tractor haulage. May we send you complete information about Lakewood Trailers and Tractors for railways?



The Lakewood Engineering Company, Cleveland U.S.A.

PENNSYLVANIA TANK CARS



Built as Carefully as the Locomotive That Hauls It

THE proven design and sturdy construction of "Pennsylvania" Tank Cars embody engineering improvements and patented features that have been thought out as carefully as those on the modern locomotive.

The New Type A-1 Center Sill, the "Pennsylvania" Center Anchorage, the Maximum Dome Outage, and the simplified "Pennsylvania" Uncoupling Rod Arrangement—all these are distinctly "Pennsylvania" features found only on the "Pennsylvania" Tank Car.

"After All, Service Counts"

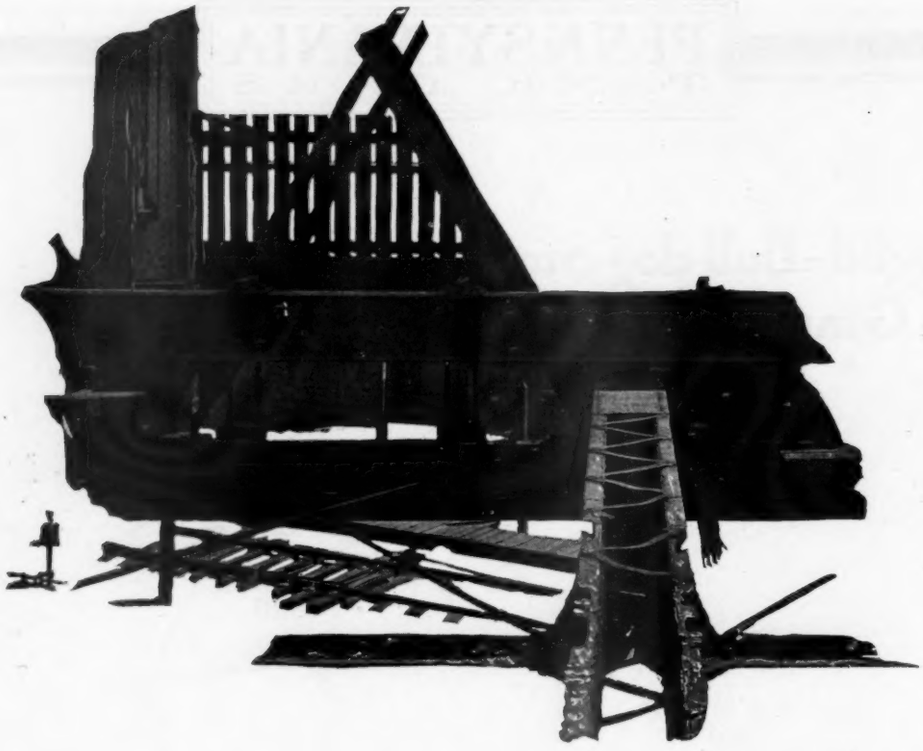
There are more than 5,000 "Pennsylvania" Tank Cars in the Pennsylvania Tank Line. These cars are leased to producers, refiners and marketers of Petroleum and other Liquid Products. Information relative to leases and operation may be obtained from any of the district offices.

Pennsylvania Tank Line
SHARON, PA.
New York St. Louis Houston San Francisco

THE PENNSYLVANIA TANK CAR COMPANY

New York St. Louis SHARON, PA. Houston San Francisco

"Pennsylvania" Tank Cars are used by Leaders of Industry



It wasn't kept painted

Under the deck of a bridge is the place where trouble has the best chance to get started. In the bridge shown, the presence of tracks below made conditions unusually severe; but, even so, Dutch Boy Red-Lead could have prevented this result.

Dutch Boy Red-Lead provides an ideal covering—strongly adhesive, tough, elastic, resistant to the action of sun, rain, and atmosphere, and long-lasting.

In most places, a bridge once well painted with three coats of Dutch Boy Red-Lead can be maintained for years at small cost by a little touching up—an important fact, with railroad finances as they are now. Because of this, Dutch Boy Red-Lead is the most economical paint.

Dutch Boy Red-Lead is furnished as a linseed-oil paste. To bring it to paint consistency, just add more linseed oil.

Insist on Dutch Boy Red-Lead for all metal surfaces, for first and finishing coats. It can be tinted as desired for the latter purpose.

Write for Painting Helps No. 8

NATIONAL LEAD COMPANY

New York	Boston	Cincinnati	San Francisco
Cleveland	Buffalo	Chicago	St. Louis

JOHN T. LEWIS & BROS. CO., Phil'adelphia

NATIONAL LEAD & OIL CO., Pittsburgh

Dutch Boy Red-Lead

49 *The map above shows the location of the 49 foundries in the United States and Canada, represented by the Association of Manufacturers of Chilled Car Wheels*

Chicago	3	Boston	Huntingdon W Va
St. Louis	2	Detroit	Wilmington, Del
Buffalo	4	St. Paul	Houston, Tex
Pittsburg	2	Kansas City, Kan	Hannibal Mo
Cleveland	2	Denver	Reading, Pa
Amherst N.S.		Tacoma	Baltimore
Montreal		Rochester, N.Y.	Richmond, Va
Mich. City, Ind		Sayre, Pa	Ft. William, Ont
Louisville		Berwick, Pa.	St. Thomas, ·
Mt Vernon, Ill.		Albany	Hamilton,
Ft. Wayne, Ind		Toronto	Ramapo, N.Y.
Birmingham		New Glasgow N.S.	Marshall, Tex
Atlanta		Madison, Ill.	Los Angeles
Savannah			Council Bluffs

AMERICAN RAILROAD ASSOCIATION STANDARDS

650 lb. wheel for 60,000 Capacity Cars
700 lb. wheel for 80,000 Capacity Cars
750 lb. wheel for 100,000 Capacity Cars
850 lb. wheel for 140,000 Capacity Cars

The Standard Wheel for Seventy Years

Where CHILLED IRON WHEELS

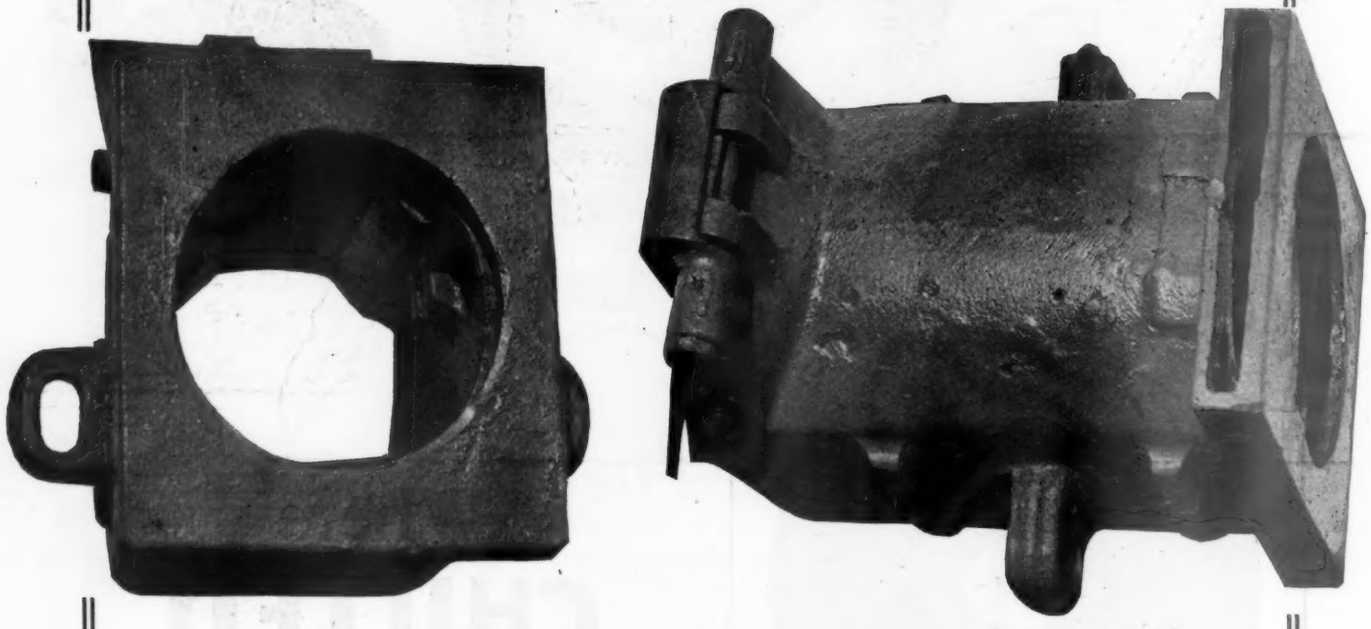
are made for Railway and Street Car Service

Capacity 20,000 per day
25,000,000 in Service

Association of Manufacturers of Chilled Car Wheels

1847 Mc Cormick Bldg.
CHICAGO

THE JOURNAL BOX
of the
DOERR SPECIAL PEDESTAL TRUCK SIDE FRAME



Is specially designed in order that certain important features may be embraced in the construction of the frame. The neutral axes of the side frame members intersect 1½ in. beyond the center line of the journal bearing, thus reducing the compound stresses in the side chord.

The crown on the top of the journal box performs a wedge function in equalizing the load on the bearings.

The journal box is made adjustable as to height of coupler by resting in slots in the side frame.

Ask for detail prints and particulars.

SCULLIN STEEL CO.

STEEL PRODUCTS

ST. LOUIS	NEW YORK	CHICAGO	ST. PAUL
Main Office & Works	2950 Grand Central Terminal	1022 McCormick Bldg.	Merchants Bank Bldg.

We Roll Standard Sizes

MERCHANT BAR

Squares, Rounds and Flats 6 in. and under.

STRUCTURAL SHAPES

Channels and Beams 8 in. and under. Angles up to 6 in.

Light rails up to 50 pounds. Special sections on request.

NOTE: *The series of advertisements begun in the issue of June 10 will be continued on July 1.*

"Railway" Products

SPRINGS

—of all types, shapes and capacity for locomotive, passenger coach and freight car equipment.

TIRES

—Locomotive driving wheel, engine truck and tender wheel, also car wheel tires.

WHEELS

—all classes of steel tired wheels in general use under locomotive and car equipment.

"RAILWAY" SERVICE

"Railway" extends a service which accepts definite responsibility. Whatever your requirements, presenting special problems, whether on old or new equipment, our engineers will furnish dependable counsel, plans and estimates.

RAILWAY STEEL-SPRING COMPANY

GENERAL OFFICES
30 Church St., New York

BRANCHES
Chicago Denver Detroit
Louisville Mexico City
St Louis St Paul Norfolk
New Orleans

Successful Railroading with Certified Malleables

When the giant locomotive with its heavy train weighing hundreds of tons takes a curve at forty or fifty or sixty miles an hour, there is a terrific impact on all track parts.

That moment tests the integrity of iron and steel; it calls for the surest and best in track materials.

Certified Malleable rail braces take the brunt of this shock. Day after day these dependable Certified Malleables stand the punishment and absorb the strain that is thrust upon them.

Material of lower quality jeopardizes life and property, and finally emphasizes the necessity of specifying Certified Malleables wherever parts must withstand shock and strain, where it is desired to eliminate breakage and where safety is a factor. Certified Malleables meet the most severe and exacting requirements of railroading.

Members Receiving Certificates for the Quarter Ending March 31st, 1921

Albany Malleable Iron Co.	Albany, N. Y.
Albion Malleable Iron Co.	Albion Mich.
American Malleable Castings Co.	Marion, O.
American Malleables Co.	Lancaster, N. Y. and Owosso, Mich.
Baltimore Malleable Iron & Steel Casting Co.	Baltimore, Md.
Belle City Malleable Iron Co.	Racine, Wis.
Chain-Belt Co.	Milwaukee, Wis.
Chicago Malleable Castings Co.	West Pullman, Chicago, Ill.
Chisholm-Moore Mfg. Co.	Cleveland, O.
Columbus Malleable Iron Co.	Columbus, O.
Danville Malleable Iron Co.	Danville, Ill.
Dayton Malleable Iron Co.	Dayton, O., and Ironton, O.
Devlin Mfg. Co., Thomas	Philadelphia, Pa.
Eastern Malleable Iron Co.—	
Naugatuck Malleable Iron Works	Naugatuck, Conn.
Bridgeport Malleable Iron Works	Bridgeport, Conn.
Troy Malleable Iron Works	Troy, N. Y.
Wilmington Malleable Iron Works	Wilmington, Del.
Vulcan Iron Works	New Britain, Conn.
Erie Malleable Iron Co.	Erie, Pa.
Federal Malleable Co.	West Allis, Wis.
Fort Pitt Malleable Iron Co.	Pittsburgh, Pa.
Fraser & Jones Co.	Syracuse, N. Y.
Globe Malleable Iron & Steel Co.	Syracuse, N. Y.
Haskell & Barker Car Co.	Michigan City, Ind.
Illinois Malleable Iron Co.	Chicago, Ill.
Iowa Malleable Iron Co.	Fairfield, Ia.
Kalamazoo Malleable Iron Co.	Kalamazoo, Mich.
Laconia Car Co.	Laconia, N. H.
Lakeside Malleable Castings Co.	Racine, Wis.
Link-Belt Co.	Indianapolis, Ind.
Marion Malleable Iron Works	Marion, Ind.
Moline Malleable Iron Co.	St. Charles, Ill.
National Malleable Castings Co.	Cleveland, O., Chicago, Ill., Indianapolis, Ind., Toledo, O., E. St. Louis, Ill.
Northern Malleable Iron Co.	St. Paul, Minn.
Northwestern Malleable Iron Co.	Milwaukee, Wis.
Pittsburgh Malleable Iron Co.	Pittsburgh, Pa.
Rhode Island Malleable Iron Works	Hillsgrove, R. I.
Rockford Malleable Iron Works	Rockford, Ill.
Ross-Meehan Foundries	Chattanooga, Tenn.
St. Louis Malleable Casting Co.	St. Louis, Mo.
Saginaw Malleable Iron Co.	Saginaw, Mich.
Standard Malleable Castings Co.	Terre Haute, Ind.
Stuwell Co.	South Milwaukee, Wis.
T. H. Symington Co.	Rochester, N. Y.
Temple Malleable Iron & Steel Co.	Temple, Pa.
Timken-Detroit Axle Co.	Canton, O.
Trenton Malleable Iron Co.	Trenton, N. J.
Union Malleable Iron Co.	E. Moline, Ill.
Vermilion Malleable Iron Co.	Hoopeston, Ill.
Wanner Malleable Iron Co.	Hammond, Ind.
Wisconsin Malleable Iron Co.	Milwaukee, Wis.
Zanesville Malleable Co.	Zanesville, O.

Cerificate holders listed here are manufacturers whose product for the quarter indicated has regularly met the requirements of the Association. In the judgment of the Association's Consulting Engineer, their plant practice is such as to produce uniform material of high character and integrity.

THE AMERICAN MALLEABLE CASTINGS ASSN.
The 1900 Euclid Building Cleveland, Ohio

POSITIVE PHYSICAL PROPERTIES
AcA CERTIFIED TRADE MARK

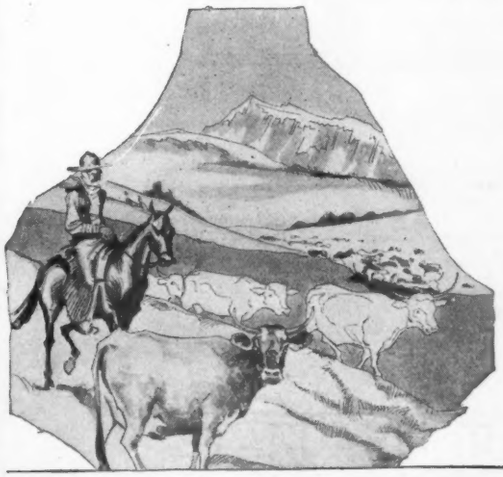
CERTIFIED-MALLEABLE CASTINGS

GENERAL AMERICAN CARS

Standard 40 Ton Stock Car

A Car for Every Industry

GENERAL AMERICAN



As purchasing agents are wont to base their preferences on the cold facts and figures of *maintenance statistics*, the very noticeable representation of "G A" cars in any large terminal, bearing the names of big railroads or big shippers, is highly significant of their superiority.

The General American Car Company designs, builds or repairs all types of cars for the shipment of either solid or liquid commodities, and serves the railroads, the shipper and the public not only by manufacturing cars but by constantly improving methods of construction and making possible better and cheaper transportation.

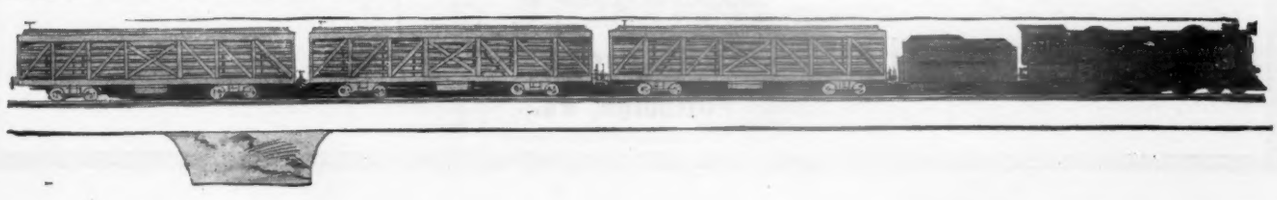
As an incident of its service the Company invites executives of railroad and manufacturing corporations, who are interested in car construction from any angle, to consult the Company's engineering staff at any time in regard to specific problems, no compensation, of course, being expected for such a consultation.

GENERAL AMERICAN CAR COMPANY

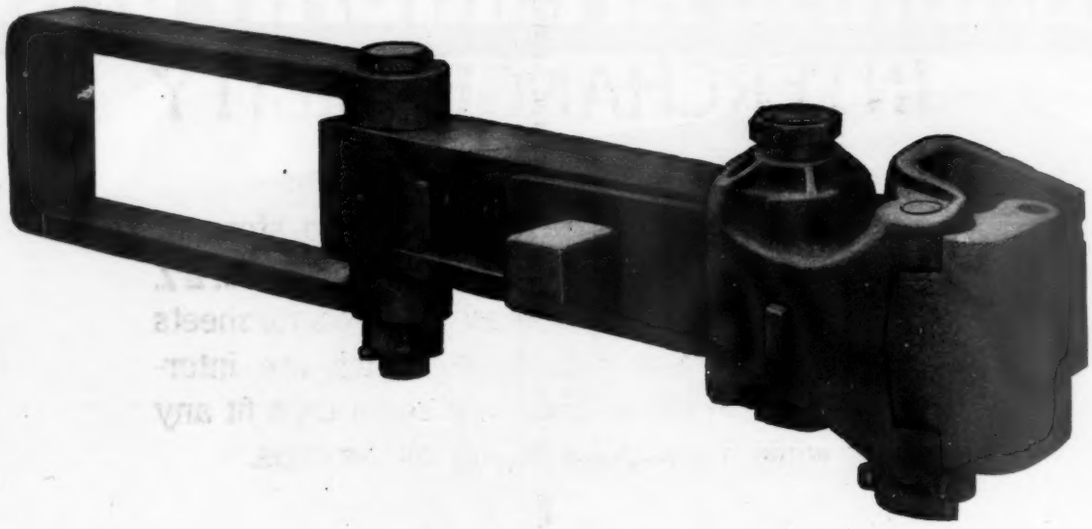
Subsidiary of the General American Tank Car Corporation

General Offices: Harris Trust Building, Chicago

Plants at: East Chicago, Ind.; Sand Springs, Okla.; Warren, Ohio
Sales Offices: 17 Battery Place, New York; 24 California St., San Francisco
Cable Address: "Gentankar, Chicago" All Codes

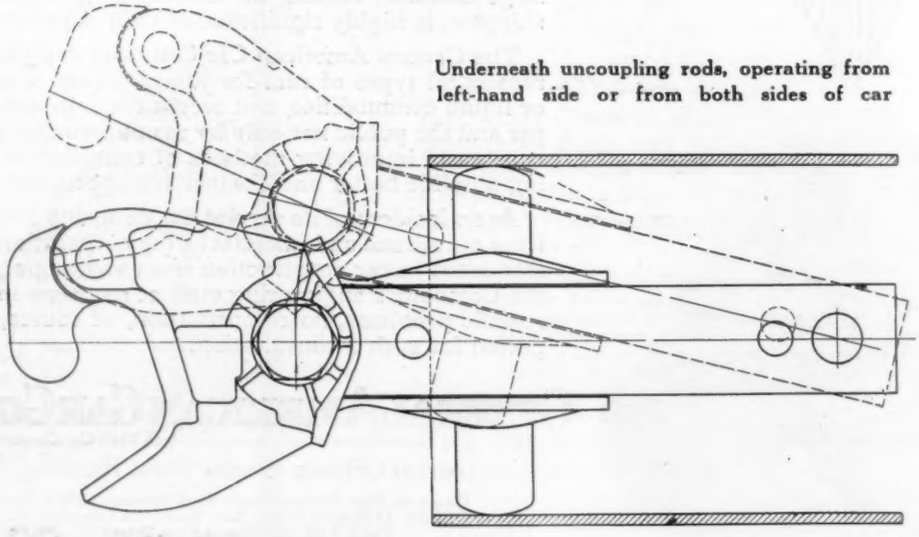


The PITT PASSENGER COUPLER



Important Features

One of the important features of this equipment is its great flexibility of curvature. It is an important feature because it relieves side strains to the car and platforms in passing over curves and tangents and thereby increases the life of the car, as well as the life of the coupler equipment, and this flexibility of connection between the cars adds also to the smooth running of the train. This flexibility is accomplished in the Pitt equipment by a pivoted coupler head in connection with a center stem having wide lateral motion in the stirrup or carrying iron, both with spring controlled movement normally keeping them on center line. The limits of such flexible movement are strikingly shown by the following cut.



Underneath uncoupling rods, operating from left-hand side or from both sides of car

MANUFACTURED BY

The McConway & Torley Co.

Pittsburgh, Pa.

INTERCHANGEABILITY

It means a great deal of time saved to store or assemble the rigid MURPHY SOLIDSTEEL ROOF. The roof shown has all intermediate sheets exactly alike, and end sheets which are interchangeable on either end. The seam caps fit any seam, while the saddles fit any of the caps.

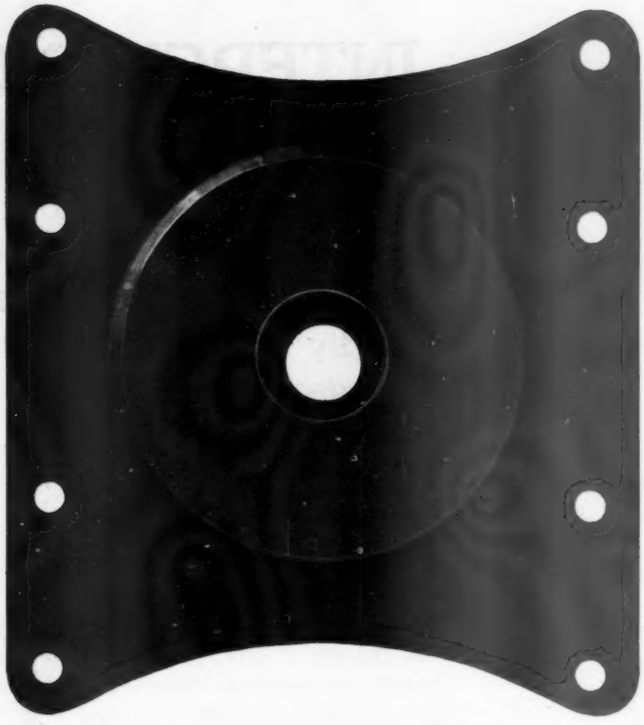
STANDARD RAILWAY EQUIPMENT CO.

MURPHY SOLIDSTEEL ROOFS

NEW YORK
CHICAGO
WASHINGTON
RICHMOND
PHILADELPHIA
ST. LOUIS
HOUSTON
KANSAS CITY
SAN FRANCISCO
MONTREAL

WORKS—NEW KENSINGTON, PA.

Truck Center Plate



Body Center Plate

Forged Car and Locomotive Axles
Crank Pins Piston Rods
Center Plates Journal Wedges
Stanforge Friction Draft Gear

THE STANDARD FORGINGS COMPANY

Offices: Railway Exchange Bldg. Chicago.

BRANCH OFFICES

New York....2040 Grand Central Terminal
St. Paul.....Merchants Nat'l Bank Bldg.
St. Louis.....Commonwealth Trust Bldg.
Milwaukee.....First National Bank Bldg.
Denver.....1617 Blake Street

BRANCH OFFICES

Detroit, Mich.....445 Book Bldg.
Houghton, Mich.....96 Sheldon St.
Salt Lake City....117 W. Second South St.

PACIFIC COAST REPRESENTATIVE

A. M. CASTLE & CO.

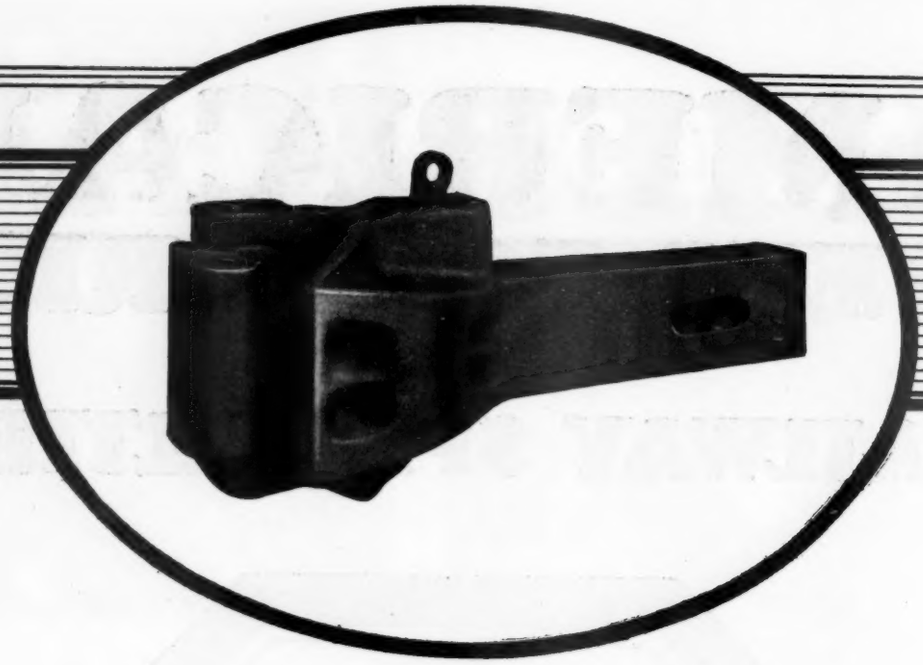
Los Angeles San Francisco
Portland Seattle

2

AMERICAN STEEL FOUNDRIES

RAILWAY SPECIALTIES

NEW YORK CHICAGO ST. LOUIS



A.R.A. Standard "D" Couplers

Made in both Top and Bottom Operating types

for

Freight, Passenger and Engine Service

This Coupler has been adopted by the American Railway Association as standard for Freight and Engine service, and is now required on all new equipment, and for repairs where possible to install.

The "SHARON" Coupler

Operates from either Top, Bottom or Side. Knuckles, Knuckle-Pins and Locks are interchangeable for all types

One-half and Three-quarter size M. C. B. type Couplers for narrow-gauge cars

THE NATIONAL MALLEABLE CASTINGS COMPANY

CLEVELAND SHARON, PA. CHICAGO MELROSE PARK, ILL. INDIANAPOLIS EAST ST. LOUIS, ILL. TOLEDO

"STANDARD"

Steel Tires

Steel Tired Wheels

Solid Rolled Steel Wheels

O. H. Steel and Malleable Iron Castings

Solid Forged Gear Blanks

Steel Forgings Iron Forgings

Forged and Rolled Steel

Pipe Flanges

Ring Dies

Rings

Roll Shells Steel Springs

"The 'Standard' Brand on your material is an assurance of eventual economy."

STANDARD STEEL WORKS CO.

GENERAL OFFICES:

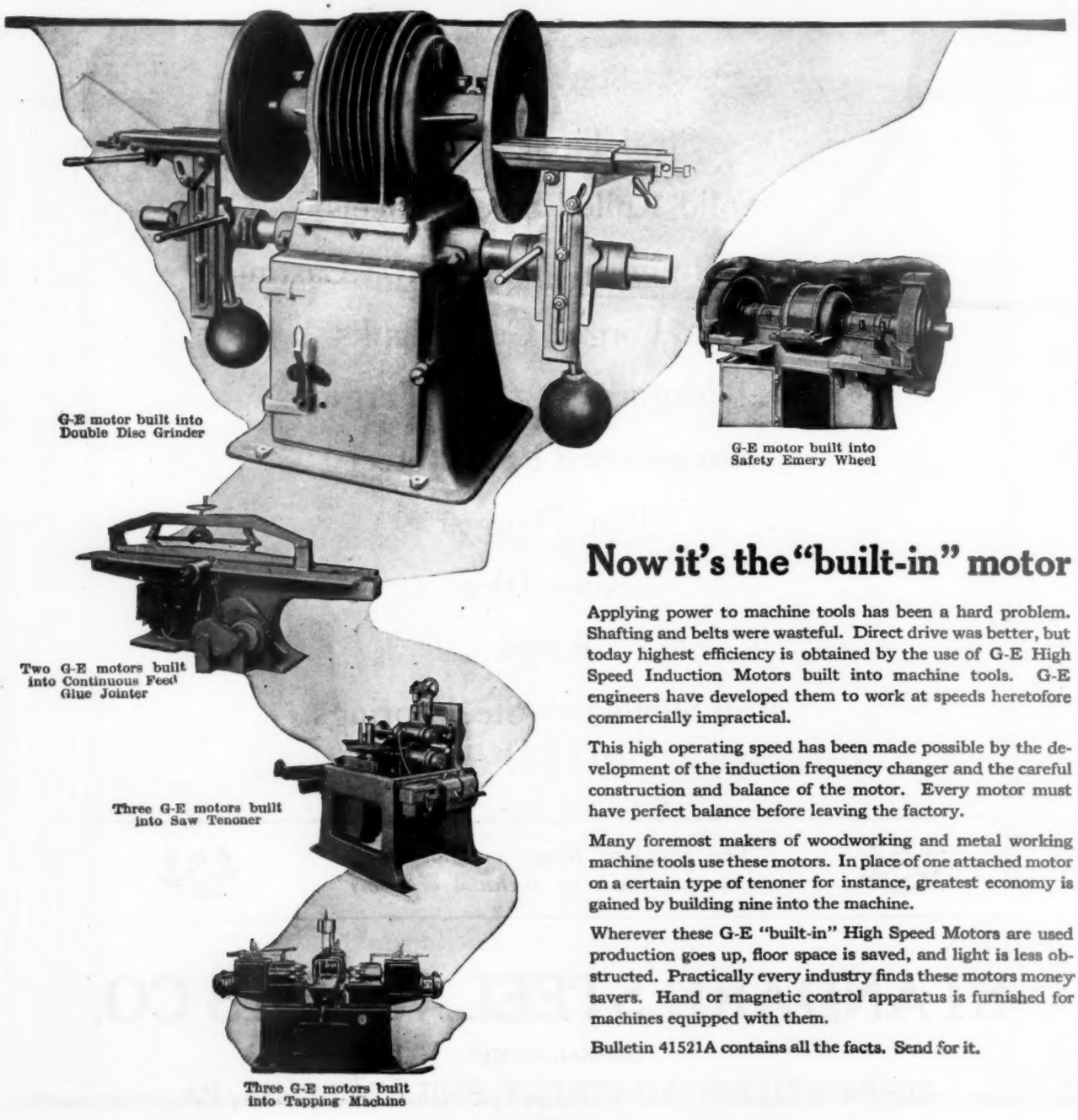
500 NORTH BROAD STREET, PHILADELPHIA, PA.

CHICAGO
ST. LOUIS
HAVANA, CUBA
HOUSTON, TEXAS

RICHMOND
SAN FRANCISCO
NEW YORK
MONTEREY, MEX.

MEXICO CITY
LONDON, ENGLAND
PARIS, FRANCE
PITTSBURGH, PA.

Modern industry has no place for the old, inefficient methods of power transmission with their high power losses and frequent service interruptions



G-E motor built into Double Disc Grinder

G-E motor built into Safety Emery Wheel

Two G-E motors built into Continuous Feed Glue Jointer

Three G-E motors built into Saw Tenoner

Three G-E motors built into Tapping Machine

Now it's the "built-in" motor

Applying power to machine tools has been a hard problem. Shafting and belts were wasteful. Direct drive was better, but today highest efficiency is obtained by the use of G-E High Speed Induction Motors built into machine tools. G-E engineers have developed them to work at speeds heretofore commercially impractical.

This high operating speed has been made possible by the development of the induction frequency changer and the careful construction and balance of the motor. Every motor must have perfect balance before leaving the factory.

Many foremost makers of woodworking and metal working machine tools use these motors. In place of one attached motor on a certain type of tenoner for instance, greatest economy is gained by building nine into the machine.

Wherever these G-E "built-in" High Speed Motors are used production goes up, floor space is saved, and light is less obstructed. Practically every industry finds these motors money savers. Hand or magnetic control apparatus is furnished for machines equipped with them.

Bulletin 41521A contains all the facts. Send for it.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

43B-607

Dependable as the Star of the North

The G-E Turbo Generator for headlight

Over Two Years Without Repair

That's the record of General Electric locomotive headlight sets in use on locomotives in belt line service around Chicago. For over two years the only attention given these sturdy little light producers was an occasional oiling and general inspection. During this period not one cent was spent for spare parts—a remarkable record.

General Electric Company

General Office Schenectady, N.Y.

28-41

"EXCUSE OUR DUST!"

Really, we have been saying so much about the Dry Lading characteristics of

Hutchins All-Steel Flexible Roofs

(*Dry Lading Roofs*)

for so long a time that we sometimes feel like apologizing for the dust we have raised.

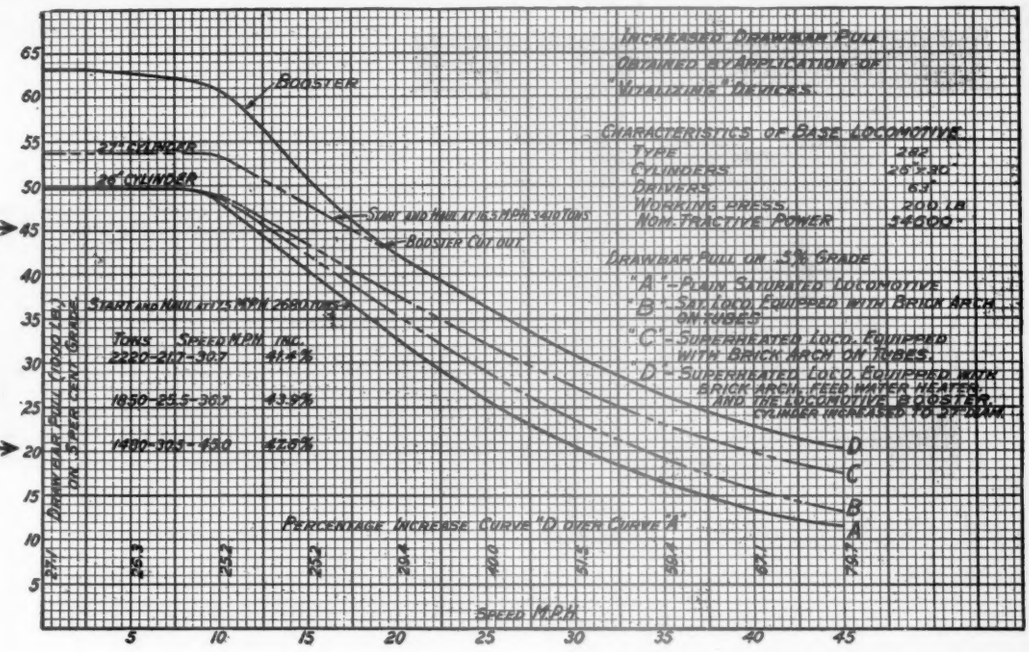
But a man carrying home his wife's package of costly dry goods has less fear of meeting an automobile on a dry street than of being overtaken by a sprinkling wagon.

This suggests mildly the theory of the Dry Lading Roof.

HUTCHINS CAR ROOFING COMPANY
DETROIT MICHIGAN

The Vitalized Engine Hauls 3410 Tons at 16 Miles per Hour. The Plain Engine Hauls 2600 Tons at 17 Miles per Hour.

The Vitalized Engine Will Haul 1480 Tons 47% Faster for the Same Fuel.


Booster
27" Cylinder
26" Cylinder
Start and Haul at 16.5 MPH. 3410 Tons
Booster Cut Out
Start and Haul at 16.5 MPH. 2600 Tons
Tons Speed M.P.H. Inc.
2220-20.7-30.7 41.8%
1850-25.5-36.7 43.9%
1480-30.5-43.0 42.9%
Drawbar Pull (1000 Lbs.) for 1% per Cent Grade
Percentage Increase Curve "D" over Curve "A"
Speed M.P.H.
Increased Drawbar Pull Obtained by Application of "Vitalizing" Devices.
Characteristics of Base Locomotive
Type 2-8-2
Cylinders 25"x30"
Drivers 63"
Working Press. 200 lb.
Nom. Tractive Power 54000#
Drawbar Pull on .5% Grade
"A"-Plain Saturated Locomotive
"B"-Sat. Loco. Equipped with Brick Arch on Tubes
"C"-Superheated Loco. Equipped with Brick Arch on Tubes
"D"-Superheated Loco. Equipped with Brick Arch, Feed Water Heater and the Locomotive Booster. Cylinder Increased to 27"x30"

↑ At This Speed (30 Miles per Hour) the Vitalizing Factors Are Equal to Half Another Engine at Half the Cost of the Same Power in a Plain Engine.

Effect of Vitalizing Factors on Locomotive Capacity

These curves show a practicable method of increasing the capacity of a plain saturated steam locomotive from 27 to nearly 80% by applying to the locomotive four vitalizing factors, the combined weight of which does not exceed 18,000 pounds. This increase in capacity is obtained with no increase in coal consumption, simply by utilizing more of the heat units in the fuel. The figures given have been substantiated by tests or in every-day operation of an actual modern locomotive.

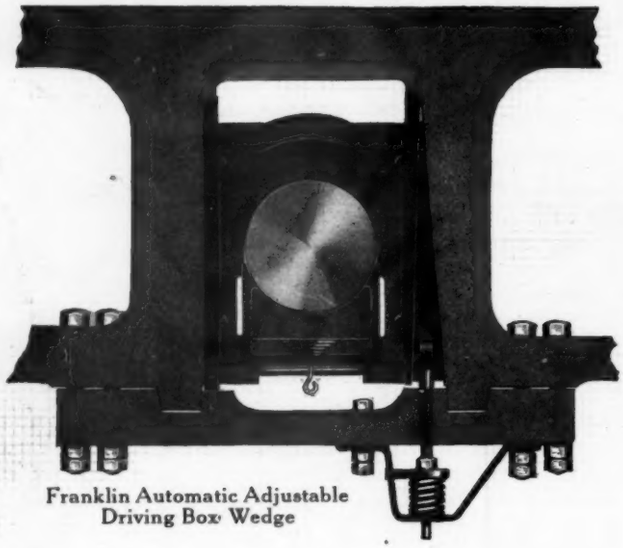
Curve A represents the drawbar pull on 0.5% grade obtainable from a plain saturated locomotive having the principal characteristics of the U. S. R. A. class 2-8-2 A, but without any of the capacity increasing devices.

Curve B shows the result achieved through the application of the fire brick arch on tubes.

Curve C shows the improvement brought about through the addition of a brick arch and a high temperature superheater.

Curve D shows the final result achieved through the application of fire brick arch, a high temperature superheater, feed water heater and the locomotive booster.

G. M. BASFORD CO.



Franklin Automatic Adjustable
Driving Box Wedge

INEXPENSIVE and EFFECTIVE

There are other ways of increasing locomotive mileage between shoppings, but there is no other way so inexpensive and so certain as by application of the Franklin Driving Box Wedge.

Mile by mile as the engine works and with all parts at running temperature, this Wedge maintains driving box adjustment by automatically compensating for wear.

Slack is stopped before it starts. Every bearing on the engine is protected.

On any engine the Franklin Wedge means reduced repair costs and increased mileage.

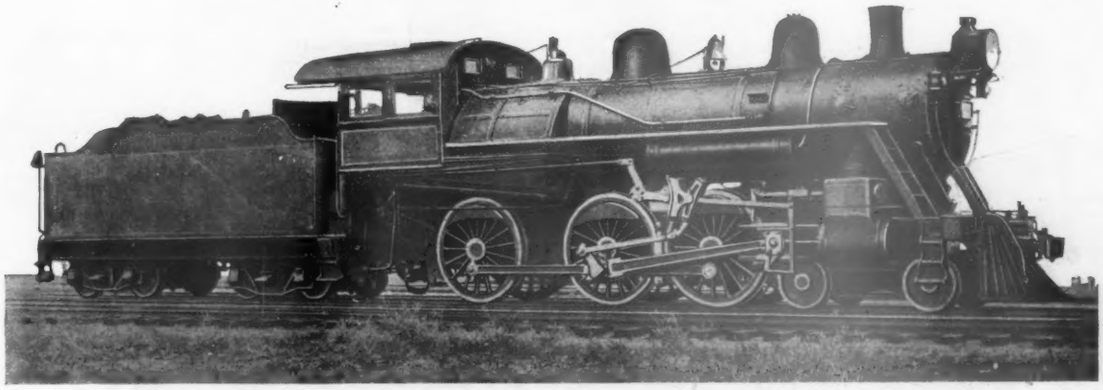
Franklin Railway Supply Company, Inc.

17 EAST 42ND STREET, NEW YORK.

332 SO. MICHIGAN AVENUE, CHICAGO, ILL.
1112 PRAETORIAN BLDG., DALLAS, TEXAS
728 MONADNOCK BLDG., SAN FRANCISCO, CAL.

Franklin Railway Supply Company of Canada, Limited, Montreal

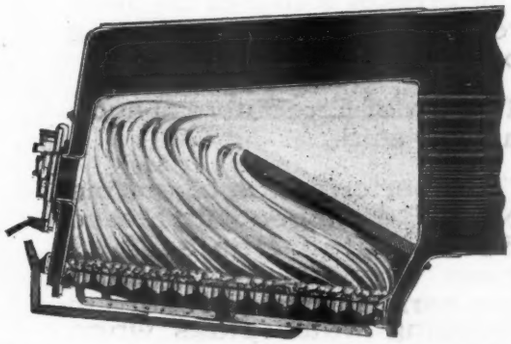
Export Department—International Railway Supply Co.—30 Church St.



With an arch this ten wheeler is good for more cars per train.

WELL-BALANCED LOADING

"Whenever a locomotive is underloaded, it contributes to a net loss in the revenue of the railroad."—L. G. Plant, before the Western Railroad Club.



An arch in the firebox adds 16% to the capacity of any locomotive.

Such is the case when a heavy locomotive hauls trains a lighter locomotive could handle.

An arch on a light locomotive often gives just the capacity needed to do the work of heavier power.

The saving in operating cost soon pays for the Arch.

Arch engines are efficient revenue earners. Ask any 100% Arch road.

AMERICAN ARCH COMPANY, Inc.

LOCOMOTIVE COMBUSTION ENGINEERS

McCormick Bldg.
Chicago

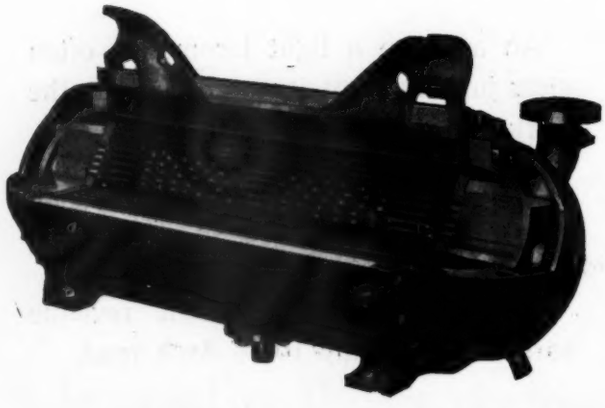
17 E. 42nd St.
New York

Water stops like these are avoided by Feed Water Heater engines.

FEWER WATER STOPS

In certain sections of the country distance between water stops actually limits the tonnage an engine can haul.

The 1,000 gallons of water an engine turns back to the tender every hour when the Elesco Feed Water Heater is working to capacity has permitted the handling of greater tonnage on such roads because of the skipping of water stops.



Elesco Feed Water Heaters Save Coal and Water.

The Chief Executive of such a road said:

"The performance of engine No. 478 equipped with Elesco Feed Water Heater has been very satisfactory and the performance in regard to skipping water plugs when there was no water to be had and yet bringing the train in was very fine."

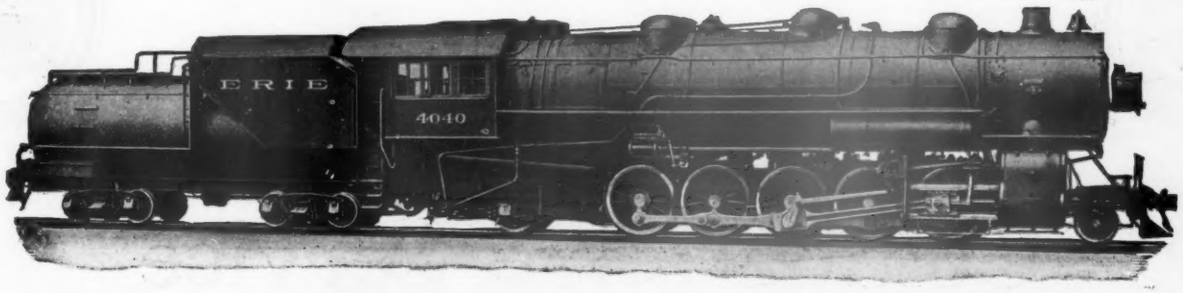
At the same time the Feed Water Heater saved 10% and more of the fuel.

The Superheater Company

General Offices : 17 East 42nd St., New York

Chicago; Peoples Gas Bldg.

For Canada ; The Superheater Co., Ltd., Transportation Bldg., Montreal



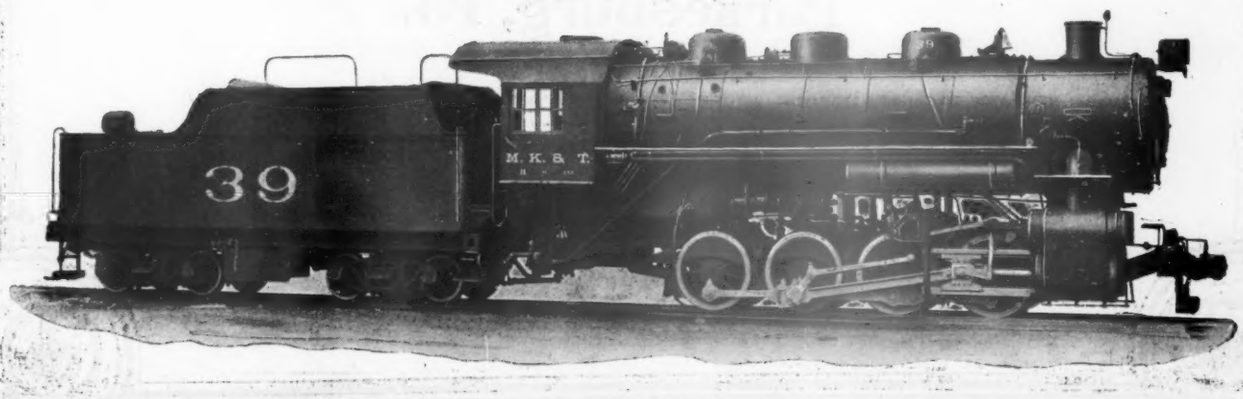
SPECIFICATIONS

Maximum ton-mile output at minimum maintenance cost demands locomotives that embody railroad company's practices that have proven themselves in service.

Lima is prepared to build exact duplicates of existing power or to co-operate with railroad engineers in designing locomotives that will even better meet the operating problems which are often changing.

Lima Locomotive Works, Incorporated

Lima, Ohio **17 East 42nd Street, New York**



PARKESBURG
Charcoal Iron Boiler Tubes

Comparative Service

Through the welding rolls a second time, for a perfect weld and improved surface. Another step towards Parkesburg Quality.

With good feed water, boiler tubes of other material may give what appears to be good service.

But the charcoal iron boiler tube, which outlasts tubes of other material under adverse water conditions, give proportionately longer service when water conditions are favorable.

When boiler tube cost is measured by service, Parkesburg Charcoal Iron Boiler Tubes cost less than tubes of any other material.

Specify Parkesburg.

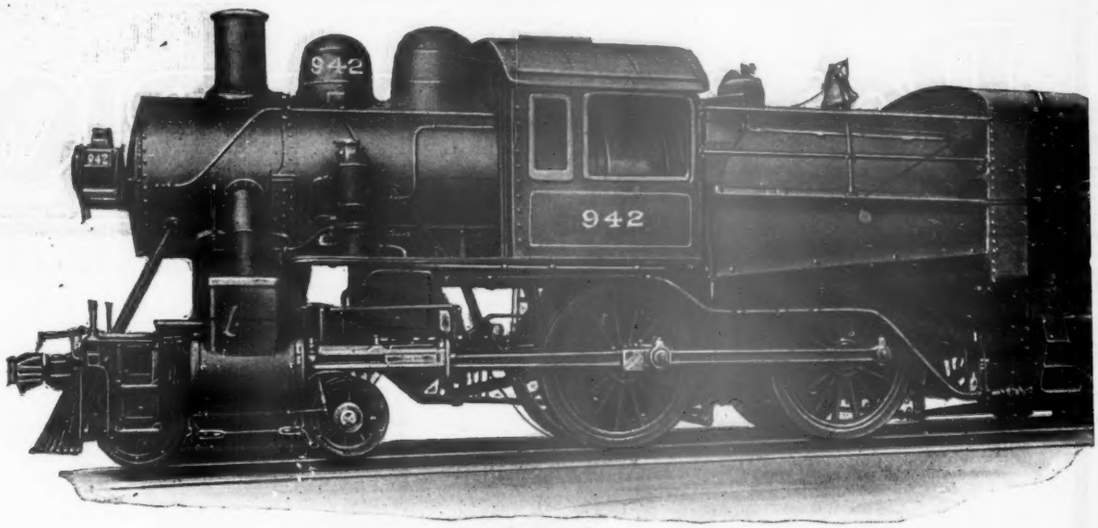
THE PARKESBURG IRON COMPANY
Parkesburg, Pa.

BRANCH OFFICES

NEW YORK, 30 CHURCH STREET — BOSTON, OLIVER BUILDING — CHICAGO, FISHER BUILDING
PHILADELPHIA, COMMERCIAL TRUST BUILDING — ST. LOUIS, SECURITY BUILDING
SAN FRANCISCO, RIALTO BUILDING — ST. PAUL, MERCHANTS NATIONAL BANK BUILDING — MONTREAL, NEW BIRKS BUILDING

EXPORT AGENTS

WONHAM, BATES & GOODE TRADING CORPORATION, NEW YORK



WHAT SUPERHEATING DOES ON THIS LOCOMOTIVE

Following its progressive motive power policy, the Delaware, Lackawanna and Western superheated their light 4-4-0 type locomotive illustrated above.

Before superheating, these locomotives exerted their maximum effort in hauling six 105,000 lb. steel cars over the Summit, between Paterson and Boonton, New Jersey. When superheated, they hauled seven of these cars over the same grade with ease. They have handled eight when necessary and maintained schedule.

The Superheater Company

General Offices: 17 East 42nd St., New York

Chicago: Peoples Gas Bldg.

For Canada: The Superheater Co., Ltd., Transportation Bldg., Montreal

ROME SUPERIOR

DURABLE STAYBOLT IRON

Rome Superior Staybolt Iron is a high grade wrought iron made from nothing but pure puddled pig iron.

Rolled, box piled and rerolled it has the sustaining structure to withstand the unequal expansion and contraction of firebox sheets.

This gives Rome Superior Staybolt Iron the durability that keeps down staybolt repair costs.

Rome Iron Mills, Inc.

Works: Rome, N. Y. 17 East 42nd St., New York

STAYBOLT IRON

Being Specialists in

Locomotive Valve Gears

We carry in stock, or can make up and furnish promptly—better and at less expense than you can make them.

Pins
Valve Rods
Eccentric Rods
Reverse Yokes
Gear Connecting Rods
Bushings
Combination Levers
Eccentric Cranks
Bell Cranks
Reverse Yokes

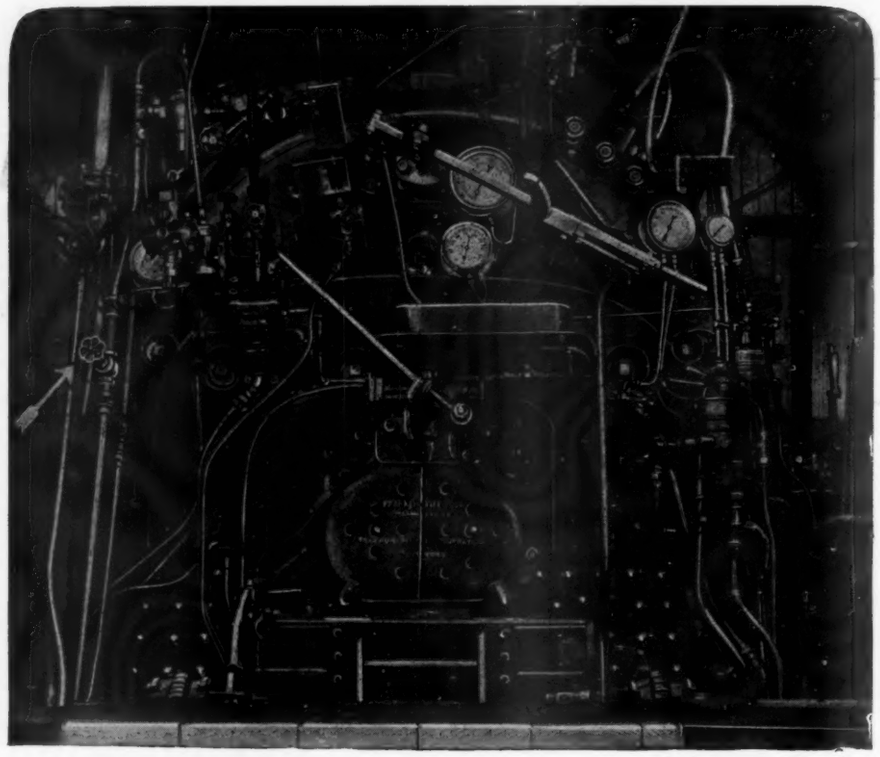
etc., etc.

We solicit a trial order to prove our contention.

THE PILLIOD COMPANY

30 Church St., New York

Works: Swanton, Ohio



Elvin Mechanical Stokers

take up a small amount of cab room and lend themselves to easy arrangement of automatic fire doors, power grate shakers and other backhead apparatus.

The arrow shows the stoker throttle which with the coal feed lever on the tender constitute the only controls required to operate the Elvin Stoker.

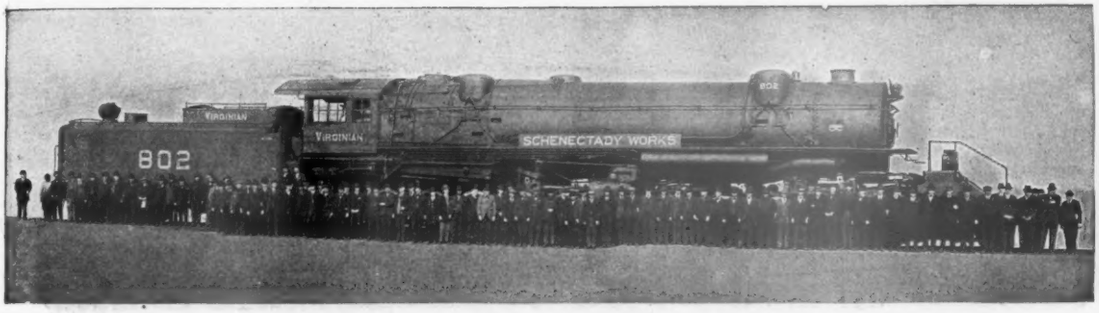
Simplicity of operation, light weight, ease of application and extraordinary low maintenance and fuel costs make the Elvin the ultimate locomotive stoker.

Why not investigate? Write today.

The Elvin Mechanical Stoker Company

50 Church Street **New York City**

17,600 Tons Hauled By One Locomotive



BUILT FOR THE VIRGINIAN RAILWAY

SPECIFICATIONS.

Total Weight of Engine,
684,000 pounds;
Weight on Driving Wheels,
617,000 pounds;
Diameter of Driving Wheels,
56 Inches;
Boiler Pressure,
215 pounds;
Cylinders,
30 & 48 x 32 inches;
Maximum Tractive Power,
working simple,
176,600 pounds;
Maximum Tractive Power,
working compound,
147,200 pounds.

On Wednesday, May 25th, on the Virginian Railway, engine No. 802, unassisted, hauled 100—120-ton capacity loaded coal cars or approximately 16,000 tons.

On Thursday, May 26th, engine No. 808, also unassisted, hauled this same tonnage train from Roanoke to Victoria, a distance of 123.4 miles, at a speed of from 15 to 18 miles an hour while running.

At Victoria ten more cars were added bringing the train up to 17,600 tons. This train was then hauled by this one locomotive over a long two-tenths of one per cent grade without difficulty.

In all probability this represents the largest tonnage ever hauled by a single locomotive.

Engines 802 and 808 are duplicate units of the order for ten built in 1918 for the Virginian Railway by the American Locomotive Company.

AMERICAN LOCOMOTIVE COMPANY
30 CHURCH STREET, NEW YORK

BARCO

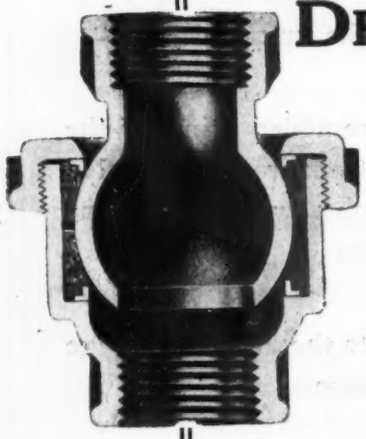
PERMANENT INVESTMENT
LOW UPKEEP
DEPENDABLE SERVICE

Three results obtained by application of

BARCO

All Metal Car Steam Heat Connections

Why buy thousands of dollars worth of new hose every steam heat season, when after installing Barco connections, a few repairs will make your Barco equipment ready for another season, year after year, and eliminate expensive and annoying delays?



BARCO Steam Heat Connections

will carry full boiler pressure without bursting or damage—no rubber lining to burn out and lodge in heating equipment.

Easier to couple and uncouple than hose.
More Flexible, even in zero weather.
Free from damage due to freezing
Interchangeable with hose.

Barco Manufacturing Company

CHICAGO, ILL.

IN CANADA
MONTREAL - TORONTO

THE HOLDEN CO., LTD.,

IN CANADA
WINNIPEG - VANCOUVER

BALDWIN

Fifty-five Years' Development in the Building of the Baldwin Consolidation Type

A CONSOLIDATION THAT DEVELOPS A TRACTIVE FORCE OF 68,200 POUNDS

Cylinders, 27" x 32".
Driving Wheels, diameter 61".
Steam pressure, 210 lbs.
Grate area, 74.9 sq. ft.
Water heating surface, 3,498 sq. ft.
Superheating surface, 945 sq. ft.
Weight on driving wheels, 268,200 lbs.
Weight, total engine, 294,900 lbs.

The Consolidations of 1866 and 1921

The original Consolidation, built for the Lehigh Valley in 1866 by The Baldwin Locomotive Works, weighed 45 tons and developed a tractive force of approximately 20,000 pounds. It represented the most powerful type of locomotive in use at that time.

The new Western Maryland Consolidations develop the highest tractive force of any eight-coupled locomotives thus far completed by the builders. They weigh more than three times as much as the old "Consolidation," and have a correspondingly greater hauling capacity. They are equipped with superheaters and arches and are stoker fired.

These locomotives are used in heavy coal traffic, and were specially designed to meet definite operating conditions. A similar method will insure satisfactory power for your road. We are prepared to cooperate in a study of your requirements.

THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

LOCOMOTIVES

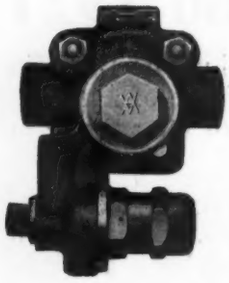
"Economy Is the Key-note of Railroad Operation."

Bench scene in the Air Brake Repair Shop.

KEEP THE OLD EQUIPMENT IN SERVICE

RAILROAD men agree that the welfare of the roads at the present time depends almost entirely on the ability to reduce operating and maintenance expenses to a reasonable ratio.

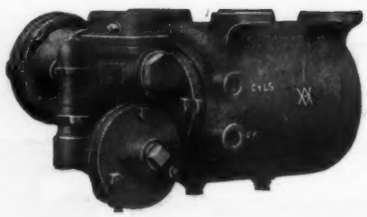
The Westinghouse Air Brake Repair Department is therefore claiming more than the ordinary attention of those officials charged with the responsibility of putting into effect every possible economy consistent with safe and efficient practice.



Our Repair Department is manned by trained specialists who have made the repair and reconstruction of Air Brake parts their life's work. The machinery at their disposal is the finest and most complete in the world for this particular purpose.

It follows as a matter of course that we are in a position to handle such work cheaper and better than the railroad itself, especially since our facilities enable us to deal in much greater volumes.

Used Triple Valves, Feed Valves, Distributing Valves, Pressure Retaining Valves, Steam Governors, etc., come from our shop as good as new.



And we keep on hand a large stock of these rebuilt unit parts from which we make immediate shipments to railroads as soon as we are advised that a repair job is ready for us. Under this arrangement the repairs are literally made and delivered before the actual parts involved reach our factory, thus saving the Railroads the loss and inconvenience of waiting until such time as would normally be required to complete the work.

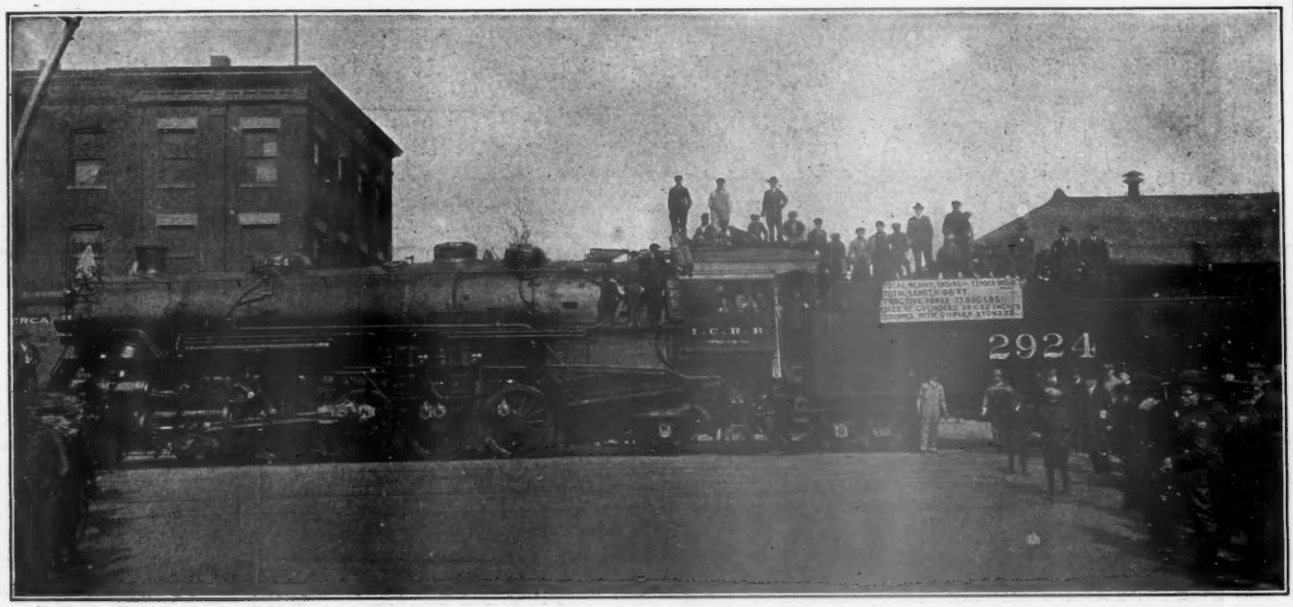
FOR OUR WESTERN CUSTOMERS

Complete Repair Departments for western customers are maintained at St. Louis, Mo., and Emeryville, Cal.

WESTINGHOUSE AIR BRAKE CO.

General Offices and Works, Wilmerding, Pa.

New York Washington Chicago St. Louis San Francisco



One of the 100 Santa Fe type engines recently put in service by the Illinois Central Railway and for which Duplex Stokers were selected. Above picture shows one of the groups of nearly 5,000 people who gathered at Springfield, Ill., to view the huge locomotive with the "Iron Fireman."

"Big Six" Points of Excellence

1—Duplex Stokers are economical in use of coal, and handle any locomotive coal with ease and dependability.

2—They have the lightest weight consistent with practical, hard service requirements.

3—They are rugged and powerful, with minimum of mechanical parts to maintain.

4—All the parts are outside of the firebox, except the very tips of the distributors, away from destructive heat, thus lessening maintenance costs.

5—They occupy no cab space actually needed by the fireman, whose working position is no longer on the foot-board up against the hot boiler head.

6—They have a flexible and thoroughly reliable engine, adapted from the time-tried Westinghouse air brake compressor, strong enough for lump coal breaking and light enough for plain stoking.

A splendid service record explains why there are—

Over 4500 of Our Stokers in Service on 76 Railroads

LOCOMOTIVE STOKER COMPANY

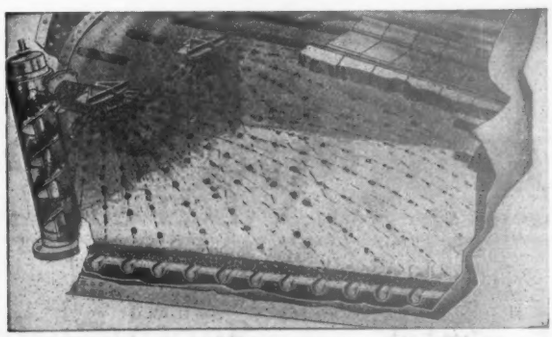
Main Office and Works
Pittsburgh, Pa.

50 CHURCH STREET
NEW YORK

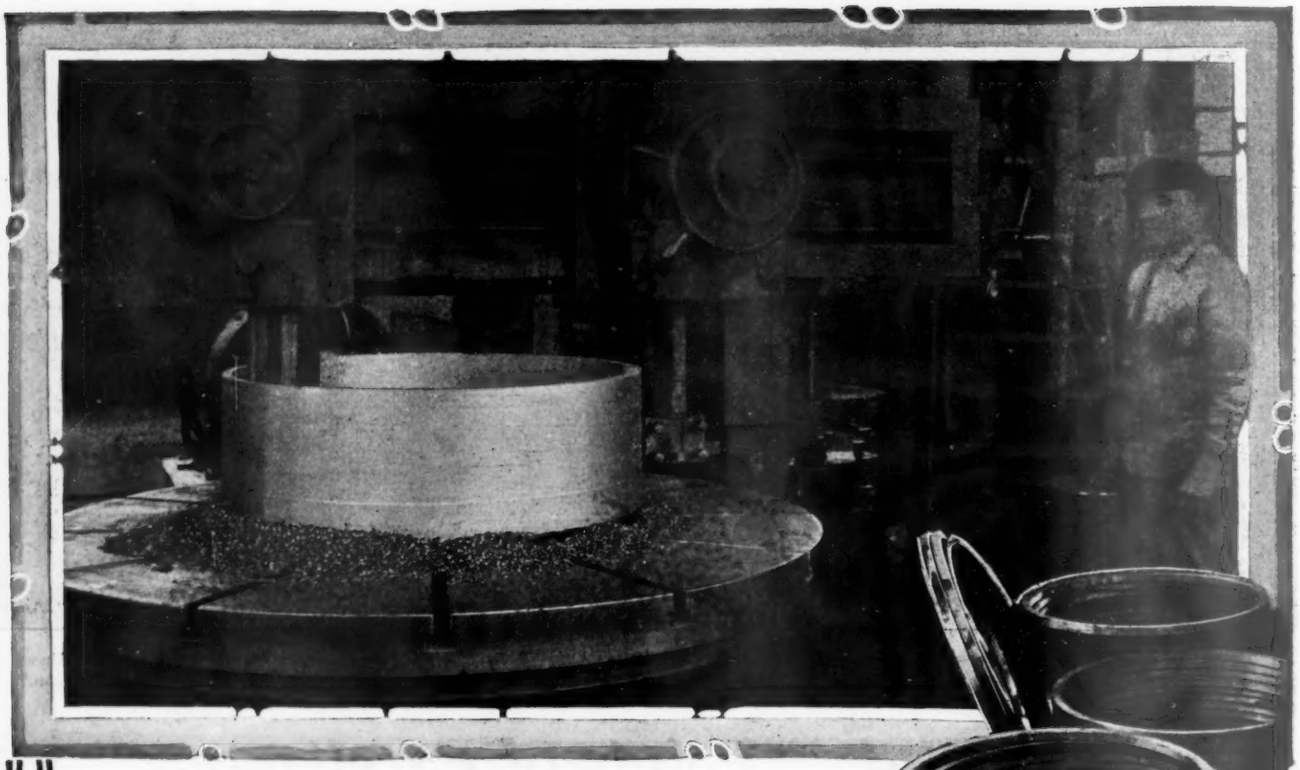
MUNSEY BUILDING
WASHINGTON, D. C.

RAILWAY EXCHANGE
CHICAGO, ILL.

WESTINGHOUSE BUILDING
PITTSBURGH, PA.



Duplex Stokers Distribute Coal Uniformly and Economically



The Big Mileage Rings

are those which are known to wear the longest and maintain "steam tightness." In order to secure these results from your piston packing rings, the most careful selection of materials must be adhered to.

Hunt-Spiller Gun Iron

fulfills the requirements. Its tough, close-grained texture provides that resilience which is the life of the ring and without which, it will soon lose its ability to maintain a steam-tight piston.

Made Only by

HUNT-SPILLER MFG. CORPORATION

W. B. Leach Pres. & Gen. Mgr. J. G. Platt, Vice-Pres. & Sales Mgr.

Office and Works

383 Dorchester Ave. South Boston, 27, Mass.

A Universal Packing

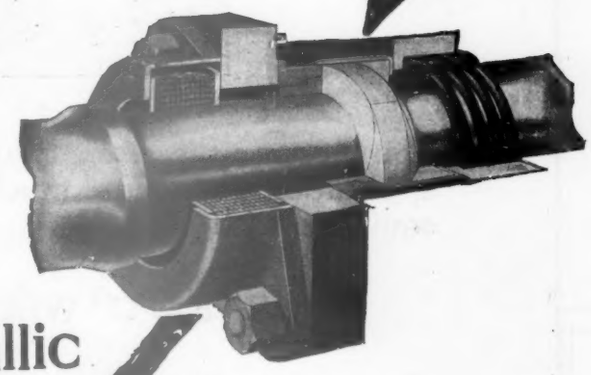
UNIVERSAL IN APPLICATION

because it can be used on piston rods, and valve stems of all type locomotives without changing design of stuffing box. This packing combines extreme simplicity with ruggedness of construction to withstand successfully the severe conditions of modern service. Engine failures due to faulty packing troubles are minimized by using

KING METALLIC PACKING

UNIVERSAL IN SAVING too,

because this packing eliminates steam leaks, reduces coal consumption, increases hauling capacity of engine, makes the entire train operation more satisfactory, and reduces roundhouse maintenance expense. Maximum efficiency and maximum service is obtained by using the King two-piece Ring, which is ably supported by the other component parts of King Packing.



For safety, service, and saving, specify complete King Metallic Packing.

The United States Metallic Packing Company

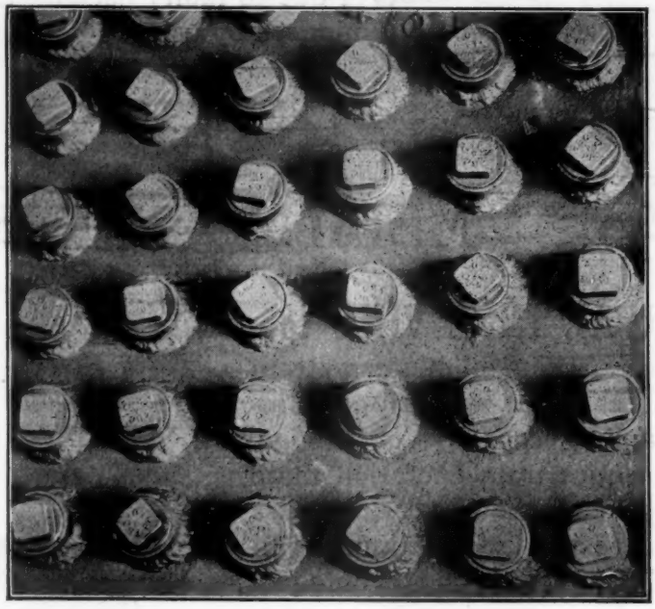
Philadelphia, Pa.

ABSOLUTELY GUARANTEED

The "F B C" Welded Flexible Staybolt is proving itself in actual service to be the best and strongest flexible staybolt yet designed.

We will guarantee the "F B C" Welded Flexible Staybolt when properly applied—for the life of your firebox.

Threaded sleeves will eventually leak, and crack, due to crystallization and the necessity of manufacturing such from cold rolled screw stock. The welded sleeves are forged and will never break, or leak, when properly applied.



You increase the strength of your boiler sheets, reduce the cost of application and secure much more service from locomotives—when equipped with

THE "F B C" WELDED FLEXIBLE STAYBOLT

We will be pleased to give you information on the guarantee section — on receipt of your request

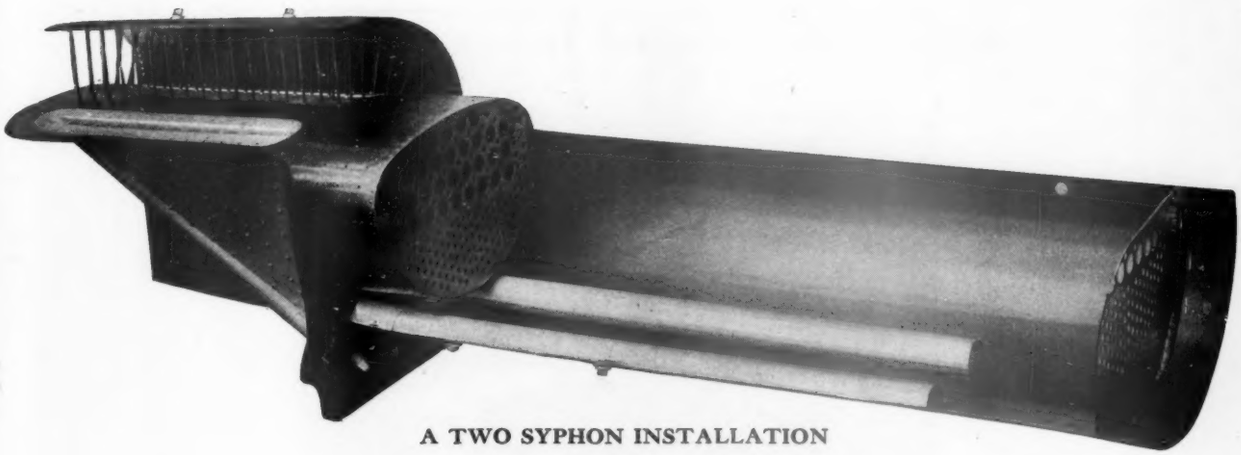
FLANNERY BOLT COMPANY

Manufacturers of "F B C" Welded and "Tate" Flexible Staybolts

PITTSBURGH, PA.

NICHOLSON THERMIC SYPHON

For Locomotive Boilers



A TWO SYPHON INSTALLATION

Numerous Locomotives are proving that Nicholson Thermic Syphons

Save 15% in fuel
Increase steaming capacity
Create complete circulation of water in boiler
Provide a new element of safety

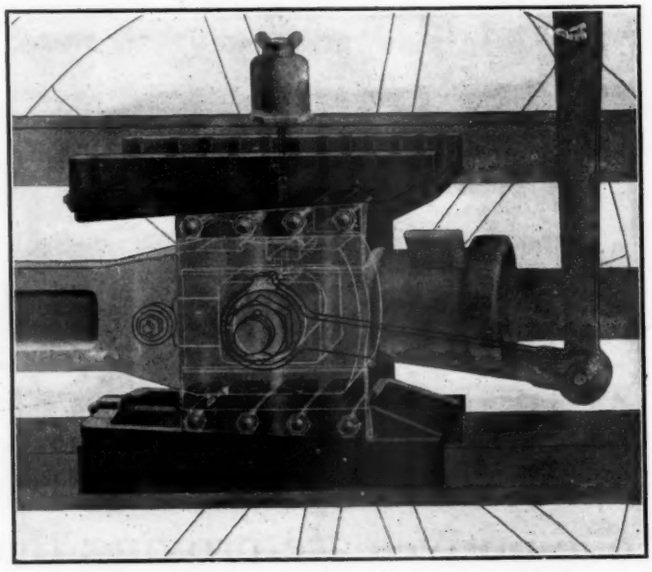
Our Circulars explain how.

LOCOMOTIVE FIREBOX CO.

MARQUETTE BLDG. **CHICAGO, ILL.**

ROGATCHOFF

The Crosshead that Pays Dividends



THE ROGATCHOFF ADJUSTABLE CROSSHEAD
Patented May 13, 1919. Other Patents Pending.

The Rogatchoff Adjustable Crosshead is making a wonderful record on heavy-duty Baltimore and Ohio locomotives.

Let us tell you what it will do on *your* road. Your crack passenger locomotives—your big freight engines—your Mallets—all will run better and pay better if equipped with Rogatchoff Adjustable Crossheads.

There's no initial investment. You save right from the start.

THE ROGATCHOFF COMPANY

205 WATER STREET, BALTIMORE, U. S. A.

Imitations of Galena Oil, at any price—cost too much!

There is no commercial or industrial service demanding the use of lubricants so exacting in quality requirements as the operation of railroads.

The high speeds, enormous weights and tremendous strains incident to the varying conditions of every day service, require lubricants of lasting strength and staying powers. None but *quality* products will withstand the rigors of railway work.

Galena Oils have always proved worthy of the confidence placed in them. Galena Oil dependability is a by-word in railroad circles. They are scientifically built products, made from scientifically selected stocks, each for a specific purpose.

In every activity of railroad service where lubrication is necessary—locomotives, cars, power houses and shop machinery—there is a Galena oil or grease especially built for the purpose specified; all *quality* products, characterized by uniformity and unfailing in serviceability.

The authentic cost records of hundreds of railroads testify to the fact that Galena Oils are by far the most economical in point of service units rendered, without considering the even greater savings accruing through ability to preserve equipment, by virtue of their supreme quality.

Galena Quality Is Our Bond and Your Security!

GALENA SERVICE

THE GALENA-SIGNAL OIL CO.

NEW YORK FRANKLIN, PA. CHICAGO

Offices in all principal American Cities

LONDON BUENOS AIRES PARIS

How the Jordan Does the Job
—The Picture Tells The Story

The result of less than 2 hours work in 9,000 feet of previously unditched road bed.

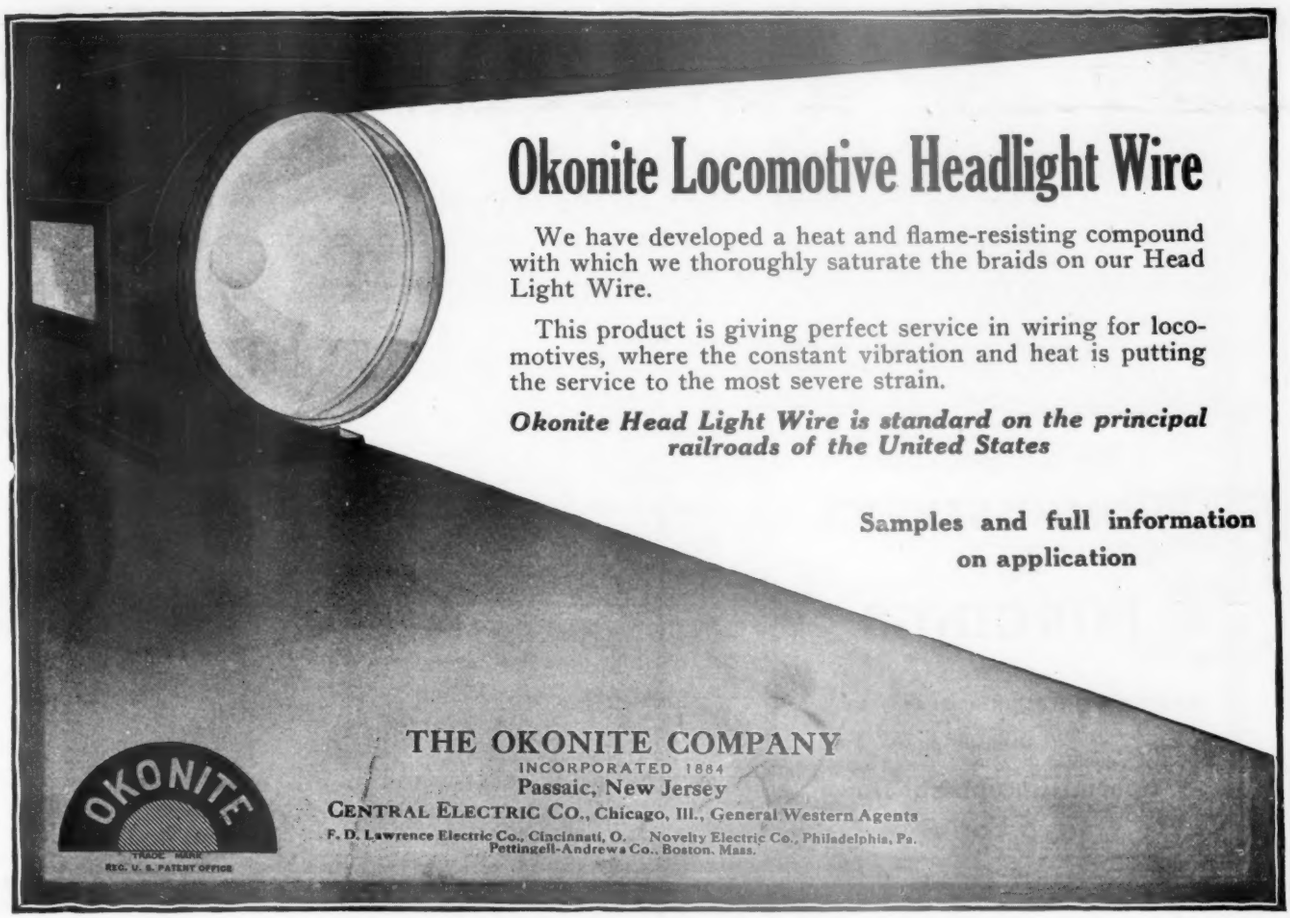
Write or wire today for figures showing what the Jordan is doing.

O. F. JORDAN COMPANY **East Chicago, Indiana**

The Ralston Steel Car Company

COLUMBUS, OHIO

Design, Build and Repair
All Classes of Freight Cars
And Steel Underframes



Okonite Locomotive Headlight Wire

We have developed a heat and flame-resisting compound with which we thoroughly saturate the braids on our Head Light Wire.

This product is giving perfect service in wiring for locomotives, where the constant vibration and heat is putting the service to the most severe strain.

Okonite Head Light Wire is standard on the principal railroads of the United States

Samples and full information on application

OKONITE
TRADE MARK
REG. U. S. PATENT OFFICE

THE OKONITE COMPANY
INCORPORATED 1884
Passaic, New Jersey
CENTRAL ELECTRIC CO., Chicago, Ill., General Western Agents
F. D. Lawrence Electric Co., Cincinnati, O. Novelty Electric Co., Philadelphia, Pa.
Pettingell-Andrews Co., Boston, Mass.

PERMANENT TRACK WEEDING
COSTS LESS THAN
TEMPORARY TRACK WEEDING
BY USING THE

ATLAS "A" SERVICE *with* ATLAS "A" WEED KILLER

Further particulars sent on request.
Write for Booklet.

CHIPMAN CHEMICAL ENGINEERING CO., INC.
136 LIBERTY STREET NEW YORK

AMERICAN BRIDGE COMPANY
HUDSON TERMINAL-30 CHURCH STREET, NEW YORK

Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS

We can now offer
PROMPT SERVICE
also on
FORGINGS

MARINE FORGINGS OF ALL KINDS

Special Equipment for
Deep Boring

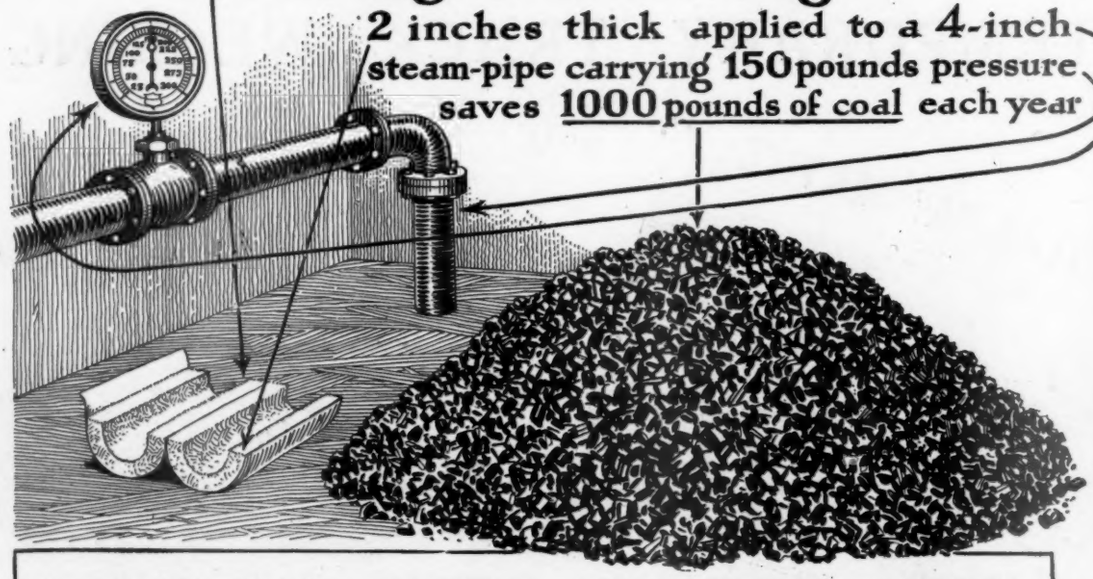
SALES OFFICES

NEW YORK, N. Y., 30 Church Street
Philadelphia, Pa. . Widener Building
Boston, Mass. . John Hancock Bldg.
Baltimore, Md., Continental Trust Bldg.
PITTSBURGH, PA. . Frick Building
Buffalo, N. Y. . Marine National Bank
Cincinnati, Ohio . Union Trust Building
Atlanta, Ga. . . Candler Building
Cleveland, Ohio . Guardian Building
Detroit, Mich., Beecher Ave. & M.C.R.R.
CHICAGO, ILL., 208 South La Salle St.
St. Louis, Mo., Third Nat'l Bank Bldg.
Denver, Colo., First Nat'l Bank Building
Salt Lake City, Utah, Walker Bank Bldg.
Duluth, Minn., . . Wolvin Building
Minneapolis, Minn., 7th Ave. & 2nd St., S.E.

Pacific Coast Representative:
U.S. Steel Products Co. Pacific Coast Dept.
SAN FRANCISCO, CAL., Rialto Building
Portland, Ore. . . Selling Building
Seattle, Wash., 4th Ave. So. Cor. Conn. St.

Export Representative
United States Steel Products Co., 30 Church St., N. Y.

Every Foot of 85% Magnesia Covering
2 inches thick applied to a 4-inch steam-pipe carrying 150 pounds pressure saves 1000 pounds of coal each year



Our revised book, "Defend Your Steam," containing a great deal of valuable and varied information—tables, charts, typical installations, etc.—on Heat Insulation, will be sent with our compliments to any one really interested in this big subject.

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When buying Drills, specify the "Shield Brand" kind. They are made in a factory constantly working toward one end—to produce only quality drills that will

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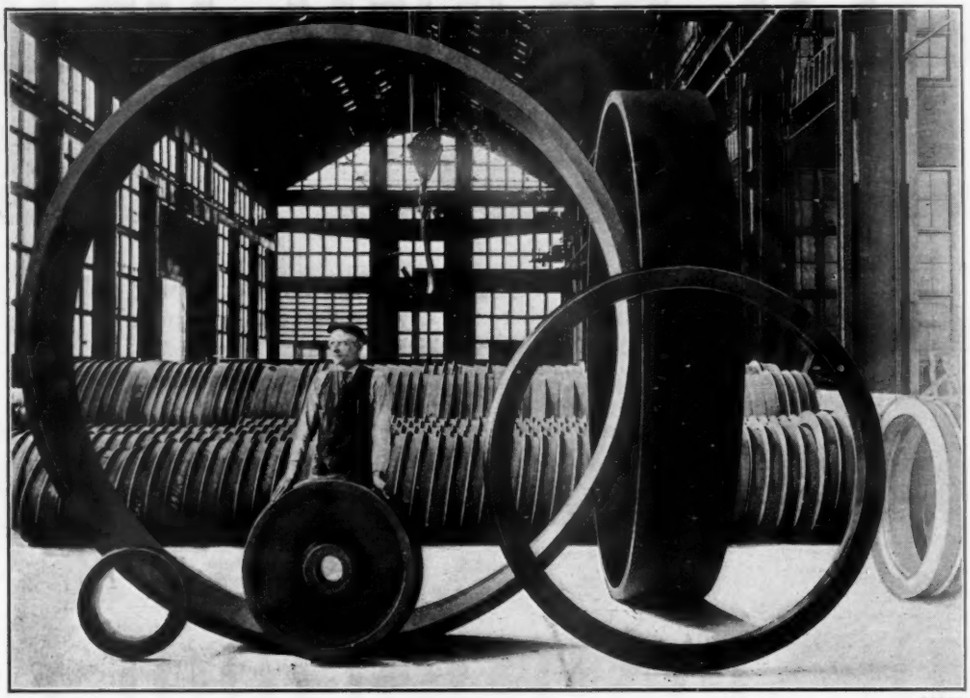
EDGEWATER STEEL COMPANY

Works and General Offices: PITTSBURGH, PA.



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LOCOMOTIVE

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THOR IRON FORGING BLOOMS,
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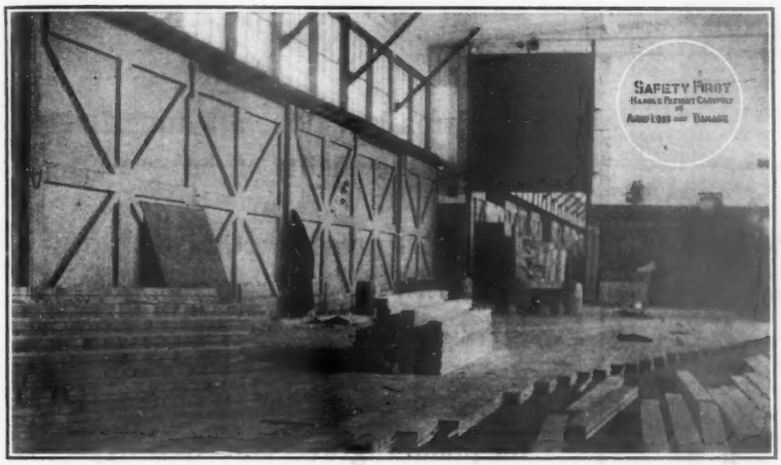
CHICAGO OFFICE RAILWAY EXCHANGE BLDG.

THE SIGN ON THE WALL

was exceedingly effective after the men were backed up with

BLOX-ON-END FLOORING



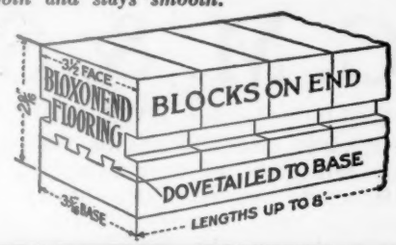
Installing Blox-on-end in the Chicago, Rock Island & Pacific R. R. freight house, Little Rock, Ark. Note the simplicity and rapidity of laying.

Every practical man knows that in order to obtain trucking efficiency and prevent freight damage and accidents, a floor smooth but not slippery must be provided. "Safety First" and "Handle freight carefully" signs have no effect on workmen if the trucking surface is not good.

BLOX-ON-END FLOORING

on account of its lasting smoothness and resiliency proven by several years test, has been adopted as standard heavy service flooring by many large trunk line railroads for machine shops, freight houses, baggage mail and express cars and other surfaces subjected to hard wear.

Write today for Booklet "F." It contains valuable information concerning Blox-on-end — the flooring that ***lays smooth and stays smooth.***



Carter Bloxonend Flooring Co.

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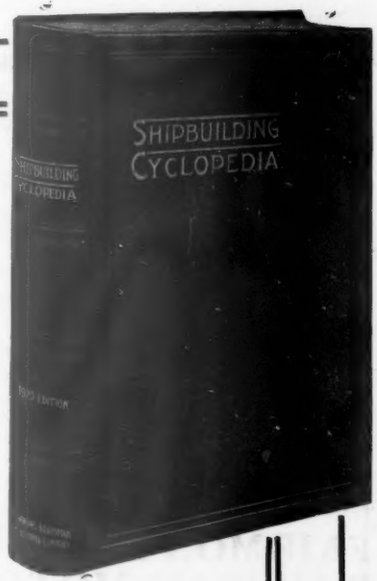
332 South Michigan Avenue, Chicago 1900 Euclid Avenue, Cleveland

"A Book of Prime Importance These Days"

HERE is what Mr. P. H. W. Ross, President, The National Marine League of the United States of America, states concerning the

SHIPBUILDING CYCLOPEDIA

"I want to tell you that I think this is one of the most magnificent publications I have ever seen, and it is an immense help to the maritime development of our country. I was positively amazed at the wealth of information contained in its pages, and I want to congratulate you very sincerely on something that is in my opinion of prime importance in these days when our people have so much to learn in the business and art of shipbuilding and ship operation."



This book consists of 1,119 pages 8 in. x 11½ in. and covers: Definitions of Shipbuilding Terms, Basic Design, Hull Specifications, Planning and Estimating, Ship's Rigging and Cargo Handling Gear, Tables of Displacement of Commodities, Arrangement and Working Drawings of Modern Vessels, and a Composite Catalog of Marine Equipment.

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The House of Transportation

If it's on transportation we can supply it.

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performance on the job COUNTS

On the C. M. & St. P.

"The Ball Bearing FAIRMONT is the lightest and most powerful engine that I have seen in my ten years of railroading. I have pulled a 3% grade against a strong wind, with myself and six men, besides 500 pounds of tools and never 'fazed' the FAIRMONT. I can very readily see that I have been wasting time and money on other engines. As for the Ball Bearing Never Leak proposition, it is one of the best parts of the motor, and the trouble-proof carburetor is sure the only thing for the average section foreman. (Signed) CHAS. E. ADAMS, Piedmont, So. Dakota.

Standardize with Fairmont Motor Cars

These times demand FAIRMONT efficiency and economy. The maintenance department on every railway system in America is striving to stop waste leakage. Several of America's most prominent systems have solved this problem.

STANDARDIZE WITH FAIRMONT MOTOR CARS. We have some interesting maintenance reports which will be of value to you. Send for your copy.

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Dept. A6 Fairmont, Minn.

Fairmont Ball Bearing Motors

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a campaign, does an advertiser guess at the quality of the art work?

Does he guess whether the copy to be used is a true representation of his goods?

Does he guess at the charges of the photo-engraver and electrotyper?

Then why guess the circulation of the publications to be used, how that circulation is obtained, where the papers go, how many paid for, how many given away and how many subscribers in arrears?

These points are vital to the success of the campaign.

It is not necessary to guess. Any publication that is worthy of the advertiser's consideration will give him complete data verified by the Audit Bureau of Circulations.

Ask for the A. B. C. report on the

Railway Age

"The House of Transportation"

A Layer of Rock for Roofing

The properties of fibrous asbestos rock are such that it seems as if nature had made this wonderful mineral especially for roofing, because it permanently resists the destructive action of time, the elements—and the ravages of fire.

Johns-Manville Asbestos Roofing is made of Asbestos rock fibre. Being all mineral, it cannot rot or disintegrate and is immune to every weather condition. Painting is never required. This roofing is truly a layer of rock for roofs—the longest lived roofing with the least cost for maintenance, and a roofing safe from communicated fires.

The following Johns-Manville Asbestos Roofings are suited to the various requirements of Railroad construction:

Built-up Roofings for Flat Decks.
Ready Roofings for steep pitch roofs.
Corrugated Asbestos used as Roofing or siding for skeleton construction.
Asbestos Shingles for decorative roof treatment on station, administration buildings, etc.

Johns-Manville Asbestos Roofings are approved by Underwriters' Laboratories, Inc., and take base rates of insurance

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INCORPORATED
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Branches in 64 Large Cities
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Canadian Johns-Manville Co., Ltd., Toronto

Through—
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and its allied products
JOHNS-MANVILLE
Heat Insulations, High Temperature Cements, Asbestos Roofings, Packings, Brake Linings, Fire Prevention Products

JOHNS-MANVILLE
Railroad Products

To Railway Operators

Carnegie Steel Company manufactures for railway use the most complete line of steel sections made in the United States; rails, cross-ties, bridge material, steel sheet piling, wheels, axles, gear blanks, car materials, slag—in fact, anything and everything within their limits the carbuilder, mechanic, or engineer of maintenance of way needs. Furthermore, its trained engineers are ever ready to serve railway executives in the solution of any problem of construction, maintenance or equipment in which wide experience in manufacture can be of assistance. Some lines in which this experience may be of particular value are:

Axles: Carnegie Steel Company makes railway axles standard forged, annealed or quenched-and-tempered. More than fifty years ago these were considered the best obtainable. They are still the standard of excellence.

Wheels: Carnegie wheels are made to withstand the most severe service. Improvements have been made in machinery and processes of manufacture to assure the utmost in service.

Cross-Ties: Steel cross-ties are the recognized standard for permanent track construction. A trial will demonstrate their economy.

Gear Blanks: The use of gears cut from Carnegie Steel Gear Blanks is a guarantee of maximum service and minimum repairs and installations of new gears.

Slag: For use in any type of concrete construction, or as ballast for roadbed, Blast Furnace Slag is the lightest and strongest coarse aggregate commercially available, and, added to this, within haulage radius from furnaces, it is the most economical.

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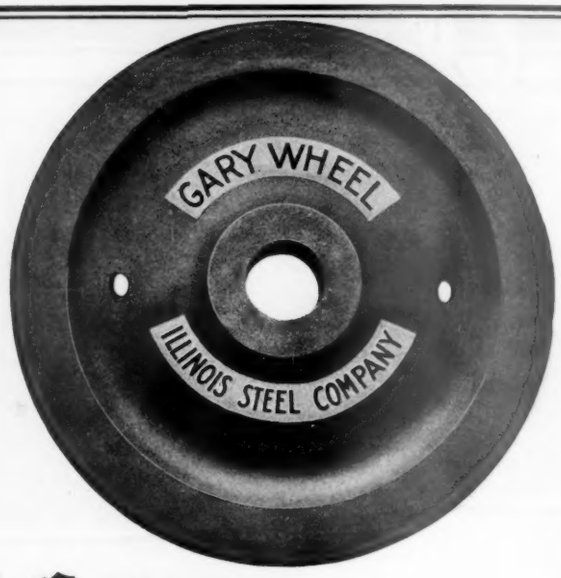
Carnegie Steel Company
General Offices: Carnegie Building, Pittsburgh, Pa.

1422

For all heavy Passenger and Freight Service SAFETY, MILEAGE and ECONOMY are essential

USE "GARY" FORGED AND ROLLED STEEL WHEELS



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Illinois Steel Company

General Offices, 208 S. La Salle Street

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Pacific Coast Representatives: U. S. Steel Products Co., San Francisco, Seattle, Portland, Los Angeles
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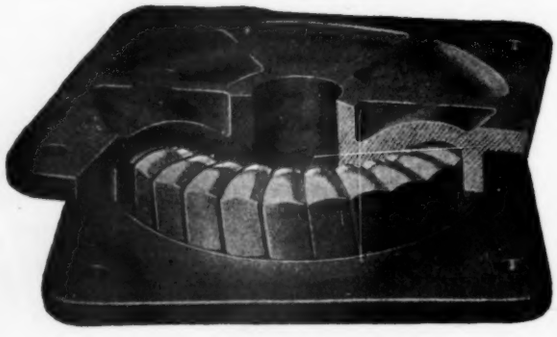
Woods' Anti-Friction Side and Center Bearings



Flat Sided Ball
Anti-Friction Center Plate

EDWIN S. WOODS & CO.

Transportation Bldg. Montreal
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Penobscot Bldg. Detroit

1

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Absolute Right-of-Way Protection

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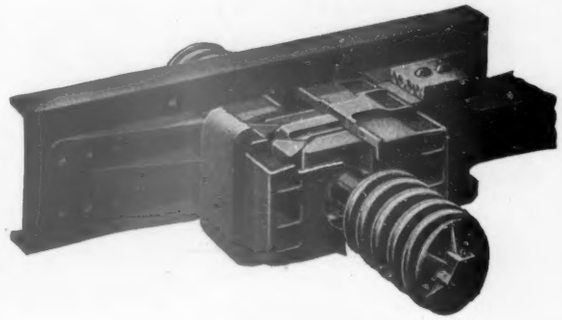
Cardwell Friction Draft Gear



Union Draft Gear Company

Chicago Office
McCormick Bldg.

Canadian Office
1023 Transportation Bldg., Montreal

H. H. HEWITT
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W. H. CROFT
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New York Chicago

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Failure to provide proper treatment for the boiler water supplies soon results in great damage to equipment, and all the while there is waste of fuel, greater boiler washing expense, and other increased costs, as well as delays in service, loss of time and reduction in tonnage hauled per engine.

Our claim for DEARBORN WATER TREATMENT is that its use inaugurates savings amounting to many times its cost. This claim has been substantiated on important railways in all parts of the world (100 in America alone).

In these times when economies must be effected in every direction possible, you will find it the greatest economy to pass the requisitions for DEARBORN and keep the supply for use continuous. You will have to spend MORE for other necessities if you spend *less* for DEARBORN.

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REG. U.S. PAT. OFF.

Dearborn Chemical Company

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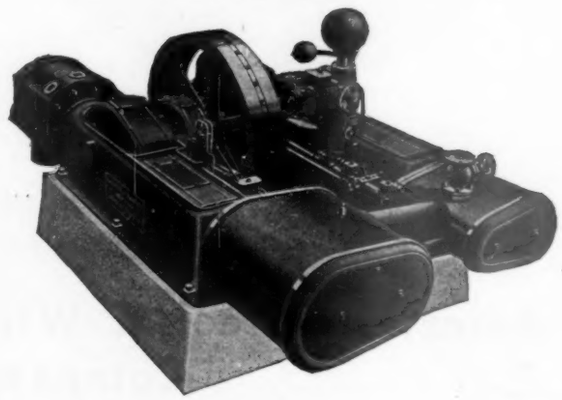
APPLY TO NEAREST OFFICE



417-C

Genuine Saving

JUST as character is what counts in a man, so the character of the material used is what counts in locomotive piston rod packing rings, and what counts big in lower packing ring maintenance cost.

ALLAN RED METAL RINGS

are made of that metal of proven worth, of such proven worth in fact that since superheating was thought of the demand for ALLAN RED METAL for locomotive piston rod packing has *increased ten fold.*

And that is easy to understand—for just as the use of ALLAN RED METAL—the Genuine 50% lead—50% copper alloy increased, the cost of packing ring maintenance decreased.

We can prove that to you—or rather ALLAN RED METAL RINGS will prove it in terms of dollars saved.

A. ALLAN & SON
Established 1891
HARRISON N. J.

OHIO
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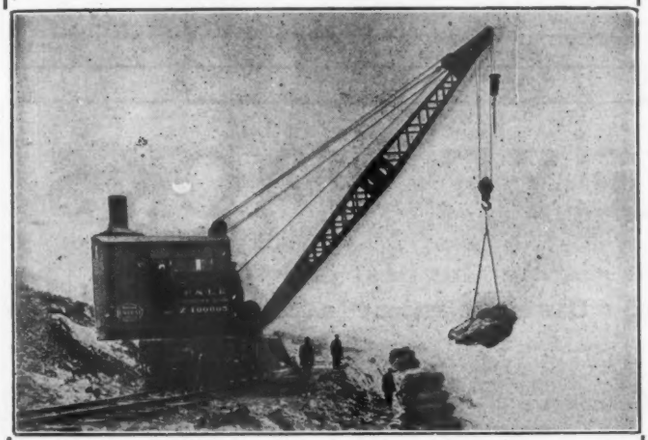
We build Locomotive Cranes Exclusively.

EXPERT knowledge of the design, construction and operating requirements of locomotive cranes is best acquired by a company that devotes its time and attention exclusively to the manufacture of locomotive cranes.

Our engineers have made a complete study of crane practices.

You can benefit from their experience.



Ohio Locomotive Crane Company
BUCYRUS SPRING ST. OHIO

TONCAN METAL

Imperial Riveted Corrugated Culverts

IMPERIALS are shaped and riveted with the utmost care. Because of this they are able to give that long, dependable service which you expect of a culvert made from anti-corrosive Toncan Metal.

We can make very prompt shipments. Write for delivered prices.

THE CANTON CULVERT & SILO CO.
CANTON OHIO, U.S.A.

Cools Off Hot Boxes Instantly

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(Signed).....G. F.

MOHAWK LUBRICATING CO.
2002 Plum Street, Cincinnati, O.

MOHAWK COOLING ...COMPOUND...

Murray Cast Steel Friction Draft Gear

and

Cast Steel Coupler Yokes

Giving the Best of Service on Thousands of Cars

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and be assured that you are getting the best jacks in design, capacity and longevity that are manufactured for all Railroad purposes

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The Diamond "S" Reinforced Shoe.

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A Link-Belt Crane is an all-around machine for general work around any plant. It may be arranged to handle hook block, self-filling grab bucket, drag line bucket, electric lifting magnet, or equipped with special boom for steam shovel attachment and pile driver.

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Our finished bolt department is perhaps one of the best equipped in the country. Any diameter ⅞ to 2" finished bolt, hollow or solid, furnished on short notice, often

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Bars in the rough, finished stays, hollow or solid.

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CUYAHOGA FALLS, OHIO

Air Dump Cars

Specify Western Air Dump Cars in your requisition. They will **outwork** and **outlast** any other make of dump car. 34 per cent greater dumping power with the same amount of air. M. C. B. construction throughout. Automatic or with side chains.

12-, 16-, 20-, 25-, 30-, and 45-cubic-yard capacity. Have you our Dump Car Catalog R-51? Send for it.

Western

Western Wheeled Scraper Co.
Earth and Stone Handling Equipment
AURORA, ILLINOIS
1

BARBER
LATERAL-MOTION DEVICE
1,000,000 in service on 43 Railroads
ROLLER SIDE-BEARINGS
Roller Center Plates
Lessens Wheel Flange Wear
Reduces Friction on Rails 15%

STANDARD CAR TRUCK CO.
McCORMICK BUILDING CHICAGO

CRECO SERVICE

CRECO

BRAKE BEAMS SIDE BEARINGS SLACK ADJUSTERS
BRAKE BEAM SUPPORTS

CHICAGO RAILWAY EQUIPMENT COMPANY, 1420 McCORMICK BLDG. CHICAGO
NEW YORK WASHINGTON MONTREAL SAN FRANCISCO

CHASE Leatherwove
MADE BY SANFORD MILLS
SANFORD, ME.

Durable rich appearing upholstery—inexpensive and distinctive.

L. C. CHASE & CO., Boston
NEW YORK DETROIT CHICAGO
SAN FRANCISCO

The standard upholstery for over a third of a century—grades for all uses.

CHASE
Goat Brand
Car Plush

SECTION CARS

INSPECTION CARS

36" AND 20" WHEELS

PUSH CARS

HAND CARS

Mudge & Company

Factory—On Belt R. R., Chicago *Main Office*—Railway Exchange, Chicago *Branch Offices*—New York, St. Louis, Denver, San Francisco

CAR LIGHTING

THE SAFETY CAR HEATING AND LIGHTING CO.

NEW YORK
CHICAGO
PHILADELPHIA
BOSTON
ST. LOUIS
SAN FRANCISCO
MONTREAL

VAPOR CAR HEATING CO., INC.

RAILWAY EXCHANGE, CHICAGO
SUCCESSOR TO
CHICAGO CAR HEATING CO. — STANDARD HEAT & VENTILATION CO., Inc.
CHICAGO NEW YORK BOSTON 408 Virginia Railway Bldg., RICHMOND, VA. PHILADELPHIA MONTREAL

GREENVILLE STEEL CAR CO.

Manufacture Steel Underframes, Pressed Steel Shapes and Forgings
Rebuild and Repair Steel Freight Cars
Greenville, Penn'a.

UNION SPRING & MANUFACTURING CO.

Coil Springs, Elliptic Springs, Steel Castings, Pressed Steel Spring Plates and Pressed Steel Journal Box Lids
KENSINGTON JOURNAL BOX—All Steel
GENERAL OFFICES: 1207 Fulton Bldg., Pittsburgh, Pa.
50 Church Street, New York, N. Y.
Fisher Building, Chicago, Ill.
Todd Building, Louisville, Ky.
Mutual Building, Richmond, Va.

CHICAGO RY. EXCHANGE
NEW YORK 50 CHURCH ST.

FERGUSON FURNACE COMPANY

Head Office
TOLEDO, OHIO
STANDARD IN RAILWAY AND LOCOMOTIVE SHOPS
WILL REDUCE FUEL AND LABOR COSTS

GRAVER

Water Softeners and Filters That Fully Meet Railway Problems, Steel Tanks and Steel Plate Work of All Kinds

GRAVER CORPORATION

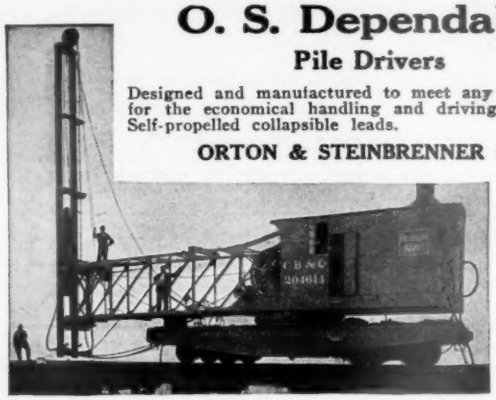
East Chicago, Ind. — Railroad Dept., Steger Bldg., Chicago

O. S. Dependable

Pile Drivers

Designed and manufactured to meet any requirements for the economical handling and driving of piles. Self-propelled collapsible leads.

ORTON & STEINBRENNER CO.



Main Offices Chicago, Ill.

Factory Huntington, Ind.

4

Patented and Patents Pending

Schaefer Truck Lever Connections

Schaefer Truck Lever Connections are made from one piece open hearth Steel; jaws drop forged; no welds. They are 40% lighter and afford 100% increased strength, reducing normal renewals about 50%.

We carry in stock lengths from 2 feet 6 inches to 3 feet 6 inches, progressing by ½ inch changes. Detailed literature upon request.

SCHAEFER EQUIPMENT CO.

General Offices

Oliver Building, Pittsburgh, Pa.

A Truthful Gage is the Only Good Gage

The Crosby Locomotive Gage

Is Found the Most Efficient in Service

Carefully Tested for Accuracy.

Non-Corrosive Movement on Socket Independent of Case.

Well Made and Durable

Manufactured and Sold by

Crosby Steam Gage & Valve Co.

Boston New York Chicago San Francisco London

5

Chicago-Cleveland Car Roofing Company

STEEL ROOFS AND CARLINES FOR BOX CARS—ALL STEEL ENDS FOR BOX AND GONDOLA CARS

535 RAILWAY EXCHANGE BUILDING Michigan and Jackson Boulevards **CHICAGO**

Machine Tools
Tool Grinders
Drill Grinders
Steam Hammers
Power Transmission

William Sellers & Co., Incorp.

PHILADELPHHIA, PA.

Valves, Strainers
Boiler Washers
Locomotive Injectors
Boiler Testers
Safety Squirts

Economy In Car Lighting

The installation of E. S. B. Constant Voltage Axle Lighting Systems in your coaches means a decided reduction in maintenance costs. Its simplicity is one reason for its economy—no lamp regulators or pole changers.

THE ELECTRIC STORAGE BATTERY CO.

Oldest and largest manufacturers in the world of storage batteries for every purpose.

1888 PHILADELPHIA 1921

Branches in 17 Cities

Exide Batteries of Canada, Limited, 153 Dufferin St., Toronto

FREIGHT CARS REBUILT

AND REPAIRED

GOOD LABOR CONDITIONS PROMPT SERVICE

The Streets Company

W. 48th & South Morgan Sts. Chicago, Illinois

WORKS ON CHICAGO JUNCTION RY. OPPOSITE U. S. YDS.

DES MOINES TANKS TRADE MARK

STRUCTURAL-PLATE WORK

We design, fabricate, and erect all types of structural steel and plate work.

Pittsburgh-Des Moines Steel Co.

879 Curry Bldg., Pittsburgh, Pa.

DES MOINES

FERALUN Anti-Slip Treads

Car Steps Floor Plates
Station Stairs Door Saddles, etc.

AMERICAN ABRASIVE METALS CO.

Boston New York Philadelphia Pittsburgh Chicago

It's Iron and Emery Cast Together

Interstate Iron and Steel Co.

Open Hearth Steel Ingots,
Billets and Slabs
Open Hearth Alloy Steels
Iron and Steel Tie Plates
Bars and Shapes—Wire Products

104 S. Michigan Ave., Chicago.

CAR SEATS

of

Pressed Steel for all Classes of Passenger Service

HEYWOOD-WAKEFIELD CO.

Factory at Wakefield, Mass.

Offices at New York, Chicago, Los Angeles, San Francisco, Houston, Washington, Portland, Ore., Toronto and Montreal.

For Track and Bridge Insulation

Continental—Bakelite or Grade E Railroad Fibre

THE CONTINENTAL FIBRE COMPANY

Factory and Main Office, Newark, Delaware

New York Office: 233 Broadway	Chicago Office: 332 S. Michigan Ave.	San Francisco Office: 525 Market St.
Pittsburgh Office: 301 Fifth Ave.	Los Angeles Office: 411 S. Main St.	Toronto (Canada) Office: 1710 Royal Bank Bldg.

EXTENSION SIDE DUMP CARS

30 cu. yds. Level Full;
43 cu. yds. Normal Loading;
100,000 pounds A. R. A. Capacity.

PITTSBURGH **CLARK CAR COMPANY**

PITTSBURGH, PA.

Chicago Peoples Gas Bldg. Boston 683 Atlantic Ave. Salt Lake City Felt Bldg.

FRICTIONLESS SIDE BEARINGS

The Wine Railway Appliance Co. Toledo, O.

Ramapo

Automatic Safety Switch Stands

Ramapo Iron Works

HILLBURN · NEW YORK

NEW YORK OFFICE 50 Church Street PLANTS Hillburn, New York Niagara Falls, New York

Switches Frogs Crossings Double Shoulder Solid Bottom Switch Riser Plates Adjustable Rail Braces Guard Rail Clamps Railbound Solid and Rolled Manganese Tee Rail Special Work Industrial Cars Etc.

Kreolite Wood Block Floors

"They outlast the factory"

GROOVED BLOCK

An excellent investment for machine shops, round houses, engine pits, foundries and other parts of the plant where the floors receive hard wear.

Write today for our booklet "Factory Floors."

THE JENNISON-WRIGHT CO.
65 Kreolite Building, Toledo, O.

National Boiler Washing Company

Of Illinois

Railway Exchange Building Chicago

Engineers and Builders of Locomotive Terminal Facilities

DEXTER P. LILLIE CO.
MACHINED
WIPING & PACKING
WASTE
INDIAN ORCHARD, MASS.

MALLEABLE IRON CASTINGS

ANNUAL CAPACITY, 25,000 TONS

FORT PITT MALLEABLE IRON CO., Pittsburgh, Pa.

---

162 RAILROADS
USE **DIXIE** CUP
Penny Vending Machines
To Solve their Drinking Cup Problems in Cars and Stations

INDIVIDUAL DRINKING CUP COMPANY, INC.
HUGH MOORE, President

ROLLED MANGANESE STEEL RAIL

Furnished in all standard sections

Effects great economy in maintenance on all curves for congested traffic

MANGANESE STEEL RAIL COMPANY
Sales Office HILLBURN NEW YORK

BOSS LOCK NUTS

UNQUESTIONED DEPENDABILITY

BOSS NUT CO. CHICAGO, U.S.A.

FIFTY PERCENT GREATER MILEAGE

and 25% saving in Oil by using Locomotive and Car Bearings made of Damascus Nickel Bronze. Will not heat to cut axle or pin.

DAMASCUS BRONZE CO.

PITTSBURGH

JOURNAL BOX LIDS

ASCO PRESSED STEEL

TRUCK SPRING PLATES

ALLEGHENY STEEL COMPANY
Brackenridge, Pa.

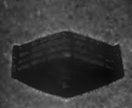
MASON SAFETY TREADS
Standard for 25 years for car and station steps.
STANWOOD STEPS
Self-cleaning, non-slipping, light weight.
KARBOLITH FLOORING
For steel cars—sanitary, fireproof, non-slippery.
AMERICAN MASON SAFETY TREAD CO., LOWELL, MASS.
Branch Offices in New York and Philadelphia
Joseph T. Ryerson & Son, Chicago, Western Distributors

ELWELL-PARKER
Electric
TRUCKS AND TRACTORS
for Freight and Passenger Terminal, Storage Battery Warehouse, Baggage and Shop Trucks.
The Elwell-Parker Electric Co.
"Pioneer Builders Electric Industrial Trucks"
Cleveland, Ohio, U. S. A.
Offices in All Principal Cities. 1

DICKINSON DEVICES
Cast Iron Smoke Jacks
Light Fire-Proof Smoke Jacks
Ventilators All Materials
Cast Iron Chimneys
Cast Iron Buildings
Telephone Booths
PAUL DICKINSON, Inc., 3354 South Artesian Ave., Chicago

FULLER ENGINEERING COMPANY
Specialists in the design and construction of
COAL PULVERIZING AND BURNING EQUIPMENT
Catalogue 700-C and 600-C, just off the press, contain valuable information pertaining to the application of pulverized fuel to locomotives and stationary boilers. We will send you a copy with pleasure.
FULLER ENGINEERING COMPANY
ALLENTOWN, PA., U. S. A.

FORT PITT SPRING AND MANUFACTURING CO.
PITTSBURGH, PA.
Manufacturers of
COIL AND ELLIPTIC
SPRINGS
FOR
RAILWAY SERVICE



SHEETS
KEYSTONE COPPER STEEL
American Bessemer—Open Hearth—Keystone Copper Steel
Black Sheets, Galvanized Sheets, Special Sheets, Corrugated Sheets, Formed Roofing Products, Tin and Terne Plates, Etc.
AMERICAN SHEET AND TIN PLATE COMPANY, PITTSBURGH, PA. 1

Nichols Transfer Tables
Turntable Tractors
Geo. P. Nichols & Bro. 2139 Fulton Street Chicago

"WAYCOTT"—"DAMASCUS"—"ANGLROD"
BRAKE BEAMS
"BRASCOTT" CAR LADDERS
THE DAMASCUS BRAKE BEAM CO.
CLEVELAND

Ashton High-Grade
Pop Valves—Steam Gages
the quality standard for over 40 years
Exclusive features insuring greatest efficiency and durability
THE ASHTON VALVE CO.
New York, Boston and Chicago

TIE PLATES *Send for Catalogue*
MANUFACTURED FROM NEW STEEL BILLETS
WORKMANSHIP AND MATERIAL GUARANTEED
THE RAILROAD SUPPLY COMPANY
BEDFORD BUILDING, CHICAGO

Columbia Nut and Bolt Co.
Incorporated
Sole manufacturers of
Columbia Lock Nuts and Columbia Gib Nuts
Also Makers of
U. S. S. Cold Punched Plain Semi-Finished and Slotted Nuts
S. A. E. Standard Plain Slotted and Turret Topped Nuts
Bridgeport, Conn.

MULE-HIDE PRODUCTS
MULE-HIDE Plastic Car Roofing.
MULE-HIDE Waterproof Canvas for roofs of Passenger Coaches, Cabooses and Cabs.
MULE-HIDE Insulating Paper for Refrigerator Cars.
MULE-HIDE FABRIC, membrane for Waterproofing Concrete Construction.
MULE-HIDE Roofing for Railroad Building, etc.
The Lehon Company, W. 45th Street and Oakley Ave, Chicago

DUNER CAR CLOSETS
Enameled Iron Wet or Dry Closets
DUNER CO.
101 S. CLINTON STREET, CHICAGO.

MISSISSIPPI WIRE GLASS CO.
220 Fifth Ave., New York
Manufacturers of Rolled Sheet Glass for Skylights and Windows.
Special Designs Increasing Daylight Illumination
Write for Catalogue and Samples.

Standard Steel Platform
In Use by 281 Companies
Sessions-Standard Friction Draft Gear
In Use by 285 Companies
Both Made by the
Standard Coupler Co., 30 Church St., New York

BROWNING

"BUCKETS THAT BITE"

Reeved Type Bucket—great biting power with sturdy design. *Clam Shell—quickly detachable—splendid digging power*

THE BROWNING COMPANY CLEVELAND

Sales Offices:

New York Seattle Salt Lake City
Chicago Portland Los Angeles
San Francisco Montreal Washington, D. C. Birmingham

2

CRANE
STEAM SPECIALTIES

5

The Champion Rivet Company
VICTOR

Boiler—Ship—Structural—Tank Rivets—Knuckle and Air Brake Pins

Main Office & Works Cleveland, Ohio

Western Plant East Chicago, Ind.

MACHINE TOOLS

For the Locomotive and Car Building Shop
For Railroad Repair Shops and General
Repair Shops—Complete equipment including
Cranes and Steam Hammers

NILES-BEMENT-POND CO.
111 BROADWAY, NEW YORK

AMERICAN Balance, SEMI-PLUG Piston and JACK WILSON

High Pressure Slide Valves and Packing Rings.

Manufactured by

C. C. YOUNG, JERSEY SHORE, PA.

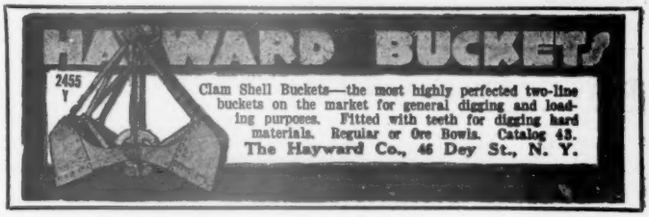
MUMMERT LUMBER & TIE CO.

McCormick Bldg. Chicago

(See advertisement in issue of June 17)

Grain Doors, Cross Ties, Switch Ties, Piling, Car Oak, Yellow Pine and Fir Lumber

Eliminate advertising and you reduce buying to its barest bread-and-butter basis.


HAYWARD BUCKETS
2455 Y
Clam Shell Buckets—the most highly perfected two-line buckets on the market for general digging and loading purposes. Fitted with teeth for digging hard materials. Regular or Ore Bowls. Catalog 43.
The Hayward Co., 46 Dey St., N. Y.

Buying a Pig in a Poke

The buying of advertising space used to be buying "a pig in a poke." The quantity and quality of circulation was shrouded in mystery and often the bag was tied against investigation.

That day has passed. The advertiser no longer depends upon "mere claims." The Audit Bureau of Circulations has united the strings to the sack and the circulation of the better class of publications is thrown open for the most searching scrutiny.

In buying advertising space in the RAILWAY AGE you are not buying "a pig in a poke." Our A. B. C. statements will stand the analysis of the most exacting investigator.

Simmons-Boardman Publishing Company

"The House of Transportation"

New York, Chicago, Cleveland, Cincinnati, Washington, D. C., London, Eng.

PROFESSIONAL DIRECTORY

THE ARNOLD COMPANY
ENGINEERS-CONSTRUCTORS
Electrical — Civil — Mechanical
Specialists in the planning of railroad properties and their construction. Offering complete service from conception to operation, eliminating hazardous division of responsibility and insuring maximum economy.
105 South La Salle Street
CHICAGO

Charles Evan Fowler
M. Am. Soc. C. E. M. Eng. Inst. Can. Consulting Civil Engineer.
BRIDGES, FOUNDATIONS
Reinforcement of Long Spans a Specialty
New York City, 25 Church St.

Pittsburg Testing Laboratory
CHICAGO—PITTSBURGH—NEW YORK
Inspection Rails, Bridges and Buildings and all Railway Supplies. CEMENT testing and inspection at Mills before shipment.
Chemical and Physical Tests.

STONE & WEBSTER
Incorporated
Design and Construct
STEAM POWER STATIONS
WATER POWER DEVELOPMENTS
TRANSMISSION LINES
SUBSTATIONS
INDUSTRIAL PLANTS GAS PLANTS
New York Boston Chicago

GEO. L. FOWLER
Consulting Mechanical Engineer
Special attention given to Shop Designing and to the Designing, Testing and Constructing of Railroad Machinery and Rolling Stock, Self-feeding Track Drills.
114 LIBERTY ST., N. Y. CITY

Railway and Industrial Engineers
Incorporated
Investigations, Inventories and Valuations
Specialists in Railway and Industrial Facilities and Equipment
Reports on Contemplated Improvements
25 Broad Street, New York
Cable Address. - - Railindeng

The Watson Engineering Company
Our complete and experienced organization is at your service for the design and construction of railway structures of every character.
Hippodrome Building
CLEVELAND

Bush, Roberts and Schaefer Co.
Engineers and Contractors
Wrigley Building, Chicago
No. 1 Madison Ave., New York
Col. Lincoln Bush, E.D., Pres.
Reinforced concrete viaducts track elevation work, railroad terminals, piers, docks, general civil engineering and construction work.

ARTHUR HALE
UNION TRUST BUILDING
FIFTEENTH AND H STREETS
WASHINGTON, D. C.
Telephone Main 7855.
Agent and attorney for carriers before the Interstate Commerce Commission, Railroad Administration, etc.

Locomotive Coaling Plants
Sand Drying Plants
Cinder Handling Plants
Roberts and Schaefer Co.
Engineers and Contractors
CHICAGO

DAY & ZIMMERMANN
Incorporated
ENGINEERS
Layout, Design and Supervision of Construction of Railroad Shops, Terminal Facilities, Power Plants, Coaling and Watering Stations.
611 Chestnut St.
PHILADELPHIA
2 Wall St. NEW YORK
Harris Trust Bldg. CHICAGO

GULICK-HENDERSON CO.
Inspecting Engineers. Inspection of Bridges. Building Materials, Railway Equipment, Cement, Pipe Machinery, etc. Examinations, Consultations, Appraisements. Physical and Chemical Laboratories.
General Offices, New York
Pittsburgh, 525-529 Third Ave.
Chicago, Ill., 421 South Dearborn St.
New York, 145 West 36th Street

DWIGHT P. ROBINSON & COMPANY
Incorporated
Engineers and Contractors
With which is consolidated
Westinghouse, Church, Kerr & Co., Inc.
Railroad Shops & Terminals
Power Plants Electrification
Coaling Stations
125 East 46th St., New York
Chicago Youngstown Dallas Los Angeles
Montreal

The J. G. White Engineering Corporation
Engineers—Constructors
Industrial Plants, Buildings, Steam Power Plants, Water Powers, Gas Plants, Steam and Electric Railroads, Transmission Systems.
43 Exchange Place, New York

JOHN E. MUHLFELD
Consulting Engineer
RAILWAY AND INDUSTRIAL EQUIPMENT, FACILITIES, INVESTIGATIONS AND VALUATIONS
25 Broad Street New York

C. E. SMITH & CO.
Consulting Engineers
2065-75 Railway Exchange, St. Louis, Mo., Chicago, Kansas City
Investigations, Reports, Appraisals, Expert Testimony, Bridge and Structural Work, Electrification. Grade Crossing Elimination, Foundations, Docks; Water Supply. River and Flood Protection, Drainage and Sanitation, Naval Architecture.

You are reading this. Place your name here and others will read your message.

Robert W. Hunt Jno. J. Cone D. W. McNaugher
ROBERT W. HUNT & CO., ENGINEERS
BUREAU OF
INSPECTION TESTS AND CONSULTATION
CHEMICAL AND PHYSICAL TESTS
ESTABLISHED OFFICES IN
CHICAGO NEW YORK PITTSBURGH ST. LOUIS SAN FRANCISCO
SEATTLE LONDON MONTREAL TORONTO VANCOUVER

U.S. CAST IRON PIPE
Unusual Facilities For Prompt Shipment
UNITED STATES CAST IRON PIPE & FOUNDRY CO.
General Offices - Burlington, N.J.

If you wish to turn your second hand equipment into cash, put an advertisement in the
Get Together Department

Classified Advertisements—Help and Situations Wanted advertisements appearing in the "Get Together Department," 5c. a word an insertion, including eleven words for address. Minimum charge $1.00 for each insertion. For Sale advertisements, $3.00 a column inch (1⅝" wide). Any number of inches may be used. Copy must be in this office by Saturday noon to insure insertion in the following week's issue.

POSITION OPEN

IF ACTUALLY QUALIFIED for salary between $2,500 and $25,000 communicate with undersigned, who will negotiate strictly confidential preliminaries for such positions; executive, administrative, technical, professional; all lines. Not an employment agency, undersigned acts in direct confidential capacity, not jeopardizing present connections. Established 1910. Send name and address only for explanatory details. R. W. Bixby, Inc., 302 Lockwood Bldg., Buffalo, N. Y.

POSITION OPEN

WANTED — Experienced man stenographer for short line railroad work. Want high class steady man and one not afraid of work. Permanent position to right party. In replying give details as to your experience and salary desired. Address Box 269, Railway Age, Woolworth Building, New York, N. Y.

NATIONALLY known manufacturer of oil storage equipment for Steam and Electric Railroads, has valuable territory open for experienced railroad specialty salesman. Personal acquaintance among operating and purchasing railroad officials advantageous. State references and experience. P. O. Box 1173, Milwaukee, Wis.

POSITION OPEN

WANTED—Experienced shortline railroad auditor. Kentucky location. Must have executive ability and experienced in handling agents' accounts, I. C. C. accounting, general bookkeeping, tariffs and rates, valuation orders, all kinds of claims, etc. High class steady man wanted, and one not afraid of work. Can also use experienced assistant auditor. In replying give details as to experience and indication of salary requirements. Address Box 270, Railway Age, Woolworth Bldg., New York, N. Y.

POSITION WANTED

POSITION WANTED—Thorough Disbursement and General Accountant, having experience with Railroad Administration and Interstate Commerce Commission, desires executive position. Address Box 268, Railway Age, Woolworth Bldg., New York, N. Y.

EDUCATIONAL

SEND for Free Special Bulletin and learn how to increase your knowledge of practical railroad work and fit yourself for promotion. The Railway Educational Bureau, Omaha, Nebr.

"1 Harrington Sons & Co. 4-spindle threading and reducing machine, in first class condition. Price on application. Address M. E. Towner, General Purchasing Agent, Western Maryland Ry. Co., 308 Morris Bldg., Baltimore, Md."

If you desire to sell or buy second-hand equipment your advertisement should appear in the

Get Together Department

Switching Locomotives For Sale

2—18x24 American. Weight 50 tons 170 pounds steam

4—20x28 American. Weight 79 tons 200 pounds steam

IN WORKING ORDER

G. S. WOOD CO.

Great Northern Bldg.
CHICAGO

2—21x30" Baldwin Consolidations, weight 89 tons, 185 pounds steam.

1—18x24" Brooks 10-wheeler, weight 56 tons, 180 pounds steam, new fire-box 1918.

1—19x26" American 10-wheeler, weight 70 tons, 190 pounds steam.

1—20x28" Pennsylvania Mogul, weight 74 tons, 185 pounds steam.

3—18x24" Brooks 6-wheel Shifters, weight 50 tons, 160 pounds steam.

BIRMINGHAM RAIL AND LOCOMOTIVE CO.
Birmingham, Ala.

RYERSON COLD SAW
High Speed, direct conn. to 3 ph. 60 cy. 220 V Motor. First-Class.
MOLINE "HOLE HOG"
Double spindle, adjustable 4" to 24". Motor driven, without motor. Excellent condition.

ZELNICKER
in ST. LOUIS

Rails, all sections in stock, immediate shipment, also quantity of bridge girders.

M. K. FRANK
Frick Bldg. Pittsburgh

New and Relaying Rails

HYMAN-MICHAELS CO.
531 Peoples Gas Bldg.,
Chicago

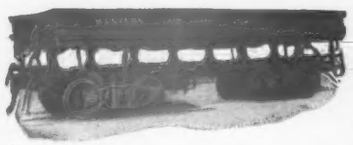
Branch Offices:

First Nat'l Bank Bldg., Pittsburgh, Pa.
Railway Exchange Bldg., St. Louis, Mo.
Room 1324, Woolworth Bldg., New York City

The Get-To-Gether Department is the show window for advertisers who have second-hand equipment for sale.—Try it.

FOR SALE OR FOR RENT

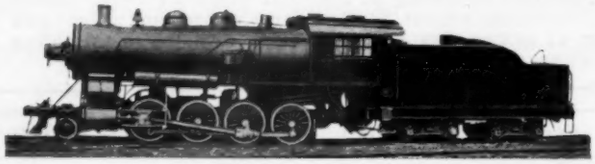
WESTERN AIR DUMP CARS



12-yd. and 16-yd. capacity.
Suitable for the heaviest construction or maintenance service.
All cars absolutely guaranteed in condition and U. S. Safety appliance standard.
Our cars now leased by twelve railroad systems.

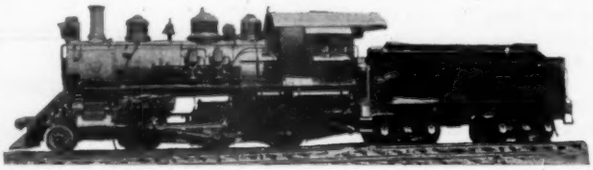
CLAPP, NORSTROM & RILEY EQUIPMENT CO.
14 So. Canal St., Chicago, Ill.

Eliminate advertising and you reduce buying to its barest bread-and-butter basis.



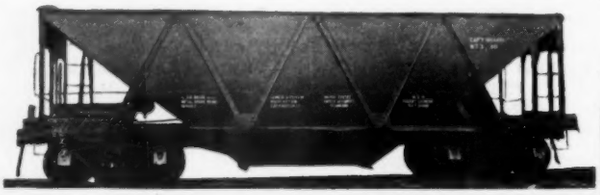
Ten Consolidations—Duplicates

21x28", piston valve; 200 lb. pressure. Some have outside valve gear. 92 tons in weight.



75 tons; 19x26"; outside valve gear; 180 lb. pressure.

70 tons; 19x26"; outside valve gear; 180 lb. pressure.



125—100,000 lb. capacity, all steel double hopper, drop bottom gondolas. Some rebuilt with extra heavy all new steel bodies.

We have in stock, ready for shipment, locomotives 24", 36" and standard gauge; 5 to 100 tons; for all classes of service; rod and geared.

Locomotive Cranes, Steam Shovels
Passenger and Freight Cars.

Rebuilt in our shops, placed in first class condition and ready for service.

Southern Iron & Equipment Co.

EST. 1889

Plant and General Offices, Atlanta, Ga.

Branch Office, New Orleans, La.

ELECTRIC LOCKING

A BOOK covering this subject in a very complete way, and written in language which is sufficiently simple to be easily understood. In this book, Mr. James Anderson, Signal Inspector of the N. Y. C. Railway Lines West divides his subject into fourteen chapters as follows:

I, Inception of Electric Locking; II, The Track Circuit; III, Trap Circuits; IV, Indication Locking; V, Section Locking; VI, Route Locking; VII, Stick Locking; VIII, Approach Locking; IX, Sectional Route Locking; X, Check Locking; XI, Outlying Switch Locking; XII, Bridge Locking; XIII, Testing; XIV, Maintenance.

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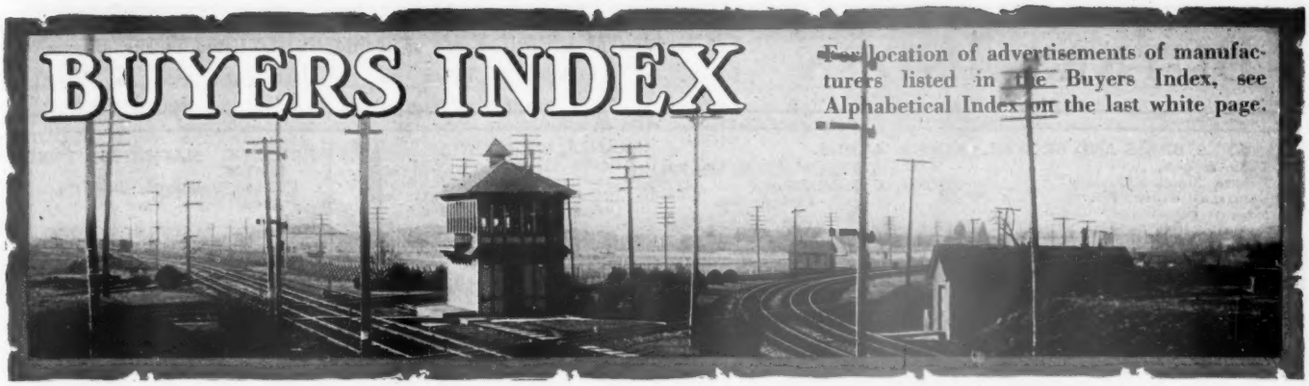

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Graver Corp.
Superheater Co., The.

HEATING AND VENTILATING, APPARATUS.
Sturtevant Co., B. F.
Vapor Car Heating Co., Inc.

HEATING SYSTEMS, CAR (ELECTRIC AND STEAM).
Safety Car Heating & Lighting Co.
Vapor Car Heating Co., Inc.
Wine Ry. Appliance Co.

HOISTING MACHINERY.
American Bridge Co.
Brown Hoisting Mchy. Co.
Industrial Works.
Link Belt Co.
Orton & Steinbrenner Co.

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Whiting Corp.

HOISTS, CHAIN
Ryerson & Son, Joseph T.

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American Hoist & Derrick Co.
Brown Hoisting Mchy. Co.
Chicago Pneumatic Tool Co.
Link Belt Co.

HOISTS, LOCOMOTIVE.
Whiting Corp.

HOISTS, PNEUMATIC.
Chicago Pneumatic Tool Co.
Ingersoll Rand Co.
Whiting Corp.

HOLDERS, ANGLE COCK.
Mudge & Co.
Railway Devices Co.

HOOKS, WRECKING.
National Malleable Castings Co.

HOPPERS, WET AND DRY (CAR).
Duner Co.

HOSE, AIR, STEAM, ETC.
Chicago Pneumatic Tool Co.
Westinghouse Air Brake Co.

HOSE, CLAMP TOOL.
Chicago Pneumatic Tool Co.

HYDROGEN.
Air Reduction Sales Co.

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Crosby Steam Gage & Valve Co.

INGOTS.
Carnegie Steel Co.
Edgewater Steel Co.
Illinois Steel Co.
McConway & Torley Co.

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Chicago Pneumatic Tool Co.

INJECTORS, STEAM.
Crosby Steam Gage & Valve Co.
Sellers & Co., Inc., Wm.

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Continental Fibre Co.
Johns-Manville, Inc.

INSULATION, HEAT.
Johns-Manville, Inc.
Lehon Co., The.
Magnesia Assn. of America.
Miner, W. H.

INSULATION, TRACK.
Continental Fibre Co.

INSURANCE, WORKMEN'S COMPENSATION.

IRON CHAIN.
Falls Hollow Staybolt Co.
Pittsburgh Forge & Iron Co.

IRON, CHARCOAL.
Falls Hollow Staybolt Co.
Parkesburg Iron Co.

IRON, HOLLOW STAYBOLT.
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IRON, REFINED.
Pittsburgh Forge & Iron Co.
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Rome Iron Mills.
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Buckeye Jack Mfg. Co.

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JOINTS, AIR RESERVOIR.
Barco Mfg. Co.

JOINTS, BLOW OFF LINE (ROUNDHOUSE).
Barco Mfg. Co.

JOINTS, COACH AND COACH YARD.
Barco Mfg. Co.

JOINTS, FLEXIBLE.
Barco Mfg. Co.
Franklin Railway Supply Co.

JOINTS, RAIL.
American Steel Foundries.
Cambria Steel Co.
Carnegie Steel Co.
Illinois Steel Co.
Railroad Supply Co.
Union Switch & Signal Co.

JOINTS, STEAM, AIR AND LIQUID.
Barco Mfg. Co.
Franklin Railway Supply Co.

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American Steel Foundries.
Gould Coupler Co.
Hunt Spiller Mfg. Corp.
National Malleable Castings Co.
Union Spring & Mfg. Co.

JOURNAL BOX WEDGES (WEDGES, JOURNAL BOX).

KILNS, DRY.
Sturtevant Co., B. F.

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Hunt & Co., Robert W.
Pittsburgh Testing Laboratory.

LADDERS, STEEL CAR.
Damascus Brake Beam Co.
Wine Railway Appliance Co.

LADLES.
Whiting Corp.

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American Rolling Mill Co.

LATHES, AUTOMATIC CHUCKING AND TURNING.
Bullard Machine Tool Co.

LATHES, AXLE.
Niles-Bement-Pond Co.
Sellers & Co., Inc., Wm.

LATHES, ENGINE.
Niles-Bement-Pond Co.
Ryerson & Son, Joseph T.

LATHES, TURRET.
Sellers & Co., Inc., Wm.

LATHES, TURRET VERTICAL.
Bullard Machine Tool Co.

LATHES, WHEEL.
Niles-Bement-Pond Co.
Sellers & Co., Inc., Wm.

LEAD, WHITE.
National Lead Co.

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Gould Coupler Co.
Electric Storage Battery Co.
Safety Car Lighting & Heating Co.

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American Locomotive Co.
Baldwin Locomotive Works.
Lima Locomotive Works.

LOCOMOTIVES, ELECTRIC.
American Locomotive Co.
Baldwin Locomotive Works.
General Electric Co.

LOCOMOTIVES, GASOLINE.
Baldwin Locomotive Works.

LOCOMOTIVES, GEARED.
Lima Locomotive Works.

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General Electric Co.

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American Locomotive Co.
Baldwin Locomotive Works

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Birmingham Rail & Loco. Co.
Southern Iron & Equip. Co.
Wood Co., G. S.
Zelnicker Supply Co., Walter A.

LOCOMOTIVES, STEAM.
American Locomotive Co.
Baldwin Locomotive Works.
Lima Locomotive Works.

LUBRICATORS, DRIVING BOX.
Franklin Railway Supply Co.

LUBRICANTS (OIL AND GREASE).
Galena Signal Oil Co.
Mohawk Lubricating Co.
Texas Co.

LUMBER.
Duncan Lumber Co.
Mummert Lumber & Tie Co.

MAGNETS, LIFTING.
Industrial Works.
Browning Co.

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Ryerson & Son, Joseph T.

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MOTORS, ELECTRIC.
General Electric Co.

NAILS.
American Steel & Wire Co.
Cambria Steel Co.
Interstate Iron & Steel Co.

NITROGEN.
Air Reduction Sales Co.

NOZZLES, EXHAUST.
Franklin Railway Supply Co.

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NUT LOCKS.
Boss Nut Co.
Columbia Nut & Bolt Co.
Franklin Railway Supply Co.

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Crane Co.
U. S. Metallic Packing Co.

OIL FILTERING AND STORAGE SYSTEMS.
Bowser & Co., S. F.
Graver Corp.

OIL, FUEL.
Texas Co.

OIL, LINSEED.
National Lead Co.

OIL PLUGS, STEAM CHEST.
Franklin Railway Supply Co.

OIL RECLAIMING SYSTEMS.
Bowser & Co., S. F.

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Galena Signal Oil Co.
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OVENS, CORE.
Whiting Corp.

OXYGEN.
Air Reduction Sales Co.

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Hunt Spiller Mfg. Corp.
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Johns-Manville, Inc.

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Chipman Chemical Engineering Co.
Lehon Co., The.
National Lead Co.

PAINT, METAL PROTECTIVE.
National Lead Co.

PAPER SHEATHING.
Chicago-Cleveland Car Roofing Co.
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Bush, Roberts & Schaefer.

PILE DRIVERS.
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Industrial Works.

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American Bridge Co.
Carnegie Steel Co.

PILING WOOD.
Duncan Lumber Co.
Mummert Lumber & Tie Co.

PINS, AIR BRAKE AND CLEVIS.
Champion Rivet Co.

PINS, CENTER.
Miner, W. H.

PINS, COUPLER KNUCKLE.
Champion Rivet Co.

PINS, CRANK.
American Locomotive Co.
Baldwin Locomotive Works.
Cambria Steel Co.
Carnegie Steel Co.
Pollak Steel Co.
Standard Forgings Co.

PIPE, CAST IRON.
Cast Iron Pipe Publicity Bureau
U. S. Cast Iron Pipe & Fdry. Co.

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PIPE, METAL CULVERT.
American Sheet & Tin Plate Co.
Canton Culvert & Silo Co.
U. S. Cast Iron Pipe & Fdry. Co.

PIPE, RIVETED STEEL.
Pittsburgh-Des Moines Steel Co.

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Niles-Bement-Pond Co.
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Illinois Steel Co.
Interstate Iron & Steel Co.
Midvale Steel & Ordnance Co.
Pittsburgh-Des Moines Steel Co.
Ryerson & Son, Joseph T.

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American Abrasive Metals Co.

PLATES, TIE.
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Interstate Iron & Steel Co.
National Malleable Castings Co.
Railroad Supply Co.

PLATES, TIN AND TERNE.
American Sheet & Tin Plate Co.

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American Locomotive Co.

PLUSH, MOHAIR.
Chase & Co., L. C.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co.
Ingersoll Rand Co.

POLES, TELEPHONE & TELEGRAPH.
Duncan Lumber Co.

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Union Switch & Signal Co.

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American Steel & Wire Co.

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White Eng. Corp., J. G.

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Chipman Chemical Engineering Co.
Jennison Wright Co.

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PUMPS AND PUMPING MACHINERY.
Ingersoll Rand Co.

PUMPS, SELF MEASURING FOR OIL, GASOLENE, KEROSENE.
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Ingersoll Rand Co.

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Ryerson & Son, Joseph T.

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Locomotive Stoker Co.

RACKS, HAT AND BAGGAGE CAR.
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General Electric Co.
Niles-Bement-Pond Co.
Union Switch & Signal Co.

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Carnegie Steel Co.
Hyman Michaels Co.
Illinois Steel Co.

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Birmingham Rail & Loco. Co.
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Southern Iron & Equip. Co.
Zelnicker Supply Co., Walter A.

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REAMERS, EXPANDING.
Standard Tool Co., The

REAMERS, SOLID.
Standard Tool Co., The

RECORDERS, SPEED.
Chicago Pneumatic Tool Co.

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Wine Railway Appliance Co.

REGULATORS, GAS PRESSURE.
Air Reduction Sales Co.

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American LaFrance Fire Engine Co.

RETORTS, CREOSOTING.
Graver Corp.

REVERSE GEAR, POWER.
Barco Mfg. Co.
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Railway Devices Co.
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Western Ry. Equipment Co.

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Pollak Steel Co.
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Chicago-Cleveland Car Roofing Co.
Hutchins Car Roofing Co.
Lehon Co., The.
Standard Railway Equipment Co.

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American Rolling Mill Co.
American Sheet & Tin Plate Co.

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SAND RAMMERS.
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Standard Tool Co., The

SAWS, HIGH SPEED FRICTION.
Ryerson & Son, Joseph T.

SAWS, PORTABLE, RAIL.
Industrial Works.

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Midvale Steel & Ordnance Co.

SCREWS, LAG.
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SEATS, CAR.
Heywood-Wakefield Co.

SHAFTING.
Falls Hollow Staybolt Co.
Pollak Steel Co.
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Pressed Steel Car Co.
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Illinois Steel Co.
Interstate Iron & Steel Co.
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Arnold Co.

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American Sheet & Tin Plate Co.
Ryerson & Son, Joseph T.

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American Sheet & Tin Plate Co.

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American Sheet & Tin Plate Co.

SHEETS, LOCOMOTIVE JACKET.
American Sheet & Tin Plate Co.

SHEETS, POLISHED OR PLANISHED IRON.
American Sheet & Tin Plate Co.

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Midvale Steel & Ordnance Co.
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Union Switch & Signal Co.

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American Steel & Wire Co.
Illinois Steel Co.
Pittsburgh Forge & Iron Co.

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American Steel Foundries.
American Steel & Wire Co.
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Pittsburgh Spring & Steel Co.
Railway Steel Spring Co.
Standard Steel Works.
Union Spring & Mfg. Co.
U. S. Metallic Packing Co.

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Ramapo Iron Works.
Union Switch & Signal Co.

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Babcock & Wilcox.
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Brown Hoisting Mchy. Co.
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Automatic Transportation Co.
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TRUCKS, INDUSTRIAL.
Automatic Transportation Co.
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General Electric Co.

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American Bridge Co.
Columbia Nut & Bolt Co.

TURNTABLES.
American Bridge Co.
Industrial Works.
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Keith Ry. Equipment Co.
Pressed Steel Car Co.
Ralston Steel Car Co.
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VALVES, BLOWER AND BLOW OFF.
Crane Co.
Crosby Steam Gage & Valve Co.

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Pilliod Co.

VALVES, CAB.
Crane Co.

VALVES, DRIFTING.
Franklin Railway Supply Co.

VALVES, GLOBE.
Crane Co.

VALVES, PISTON.
Franklin Railway Supply Co.
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VALVES, POP, SAFETY AND RELIEF.
Ashton Valve Co.
Crane Co.
Crosby Steam Gage & Valve Co.
Westinghouse Air Brake Co.

VALVES, PRESSURE REGULATING.
Crane Co.

VARNISHES.
Murphy Varnish Co.

VAULTS, BATTERY.
Railroad Supply Co.

VENTILATORS, CAR.
Mudge & Co.
Vapor Car Heating Co., Inc.
Wine Railway Appliance Co.

VENTILATORS, SHOP AND ROUNDHOUSE.
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Johns-Manville, Inc.
Sturtevant Co., B. F.

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Gould Coupler Co.

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National Malleable Castings Co.
Sellers & Co., Inc., Wm.
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Link Belt Co.

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National Boiler Washing Co.

WASTE COTTON AND WOOLEN.
Lillie Co., Dexter P.

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Dearborn Chemical Co.
Graver Corp.

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Railway Devices Co.
Standard Forgings Co.
Western Ry. Equip. Co.

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Chipman Chemical Engineering Co.

WELDING MACHINES, FLUE.
Ryerson & Son, Joseph T.

WELDING AND CUTTING APPARATUS—(SEE CUTTING AND WELDING APPARATUS).

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American Rolling Mill Co.

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American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works.
Edgewater Steel Co.
Lima Locomotive Works.
Midvale Steel & Ordnance Co.
Pressed Steel Car Co.
Railway Steel Spring Co.
Standard Steel Works.

WHEELS, CAST IRON.
Assn. of Mfrs. of Chilled Car Wheels.
Pressed Steel Car Co.

WHEELS, MINE CAR.
Carnegie Steel Co.
Edgewater Steel Co.
Fuller Engineering Co.
Illinois Steel Co.

WHEELS, PRESSED STEEL MOTOR CAR.
Fairmont Gas Engine Ry. Motor Car Co.
Mudge & Co.

WHEEL SPROCKET.
Fuller Engineering Co.
Link Belt Co.

WHEELS, STEEL AND STEEL TIRED.
Cambria Steel Co.
Carnegie Steel Co.
Edgewater Steel Co.
Illinois Steel Co.

WHEEL CENTERS, DRIVING.
American Locomotive Co.
American Steel Foundries.
Baldwin Locomotive Works.
Edgewater Steel Co.
Hunt Spiller Mfg. Corp.
Standard Steel Works.

WHISTLES, LOCOMOTIVE.
Ashton Valve Company.
Crosby Steam Gage & Valve Co.
General Electric Co.
Westinghouse Air Brake Co.

WINCHES.
Chicago Pneumatic Tool Co.

WIRE.
American Steel & Wire Co.
Kerite Insulated Wire & Cable
Okonite Co.

WIRE, BARB.
American Steel & Wire Co.

WIRE, FENCE.
American Steel & Wire Co.
Interstate Iron & Steel Co.

WIRE, INSULATED.
American Steel & Wire Co.
General Electric Co.
Kerite Insulated Wire & Cable
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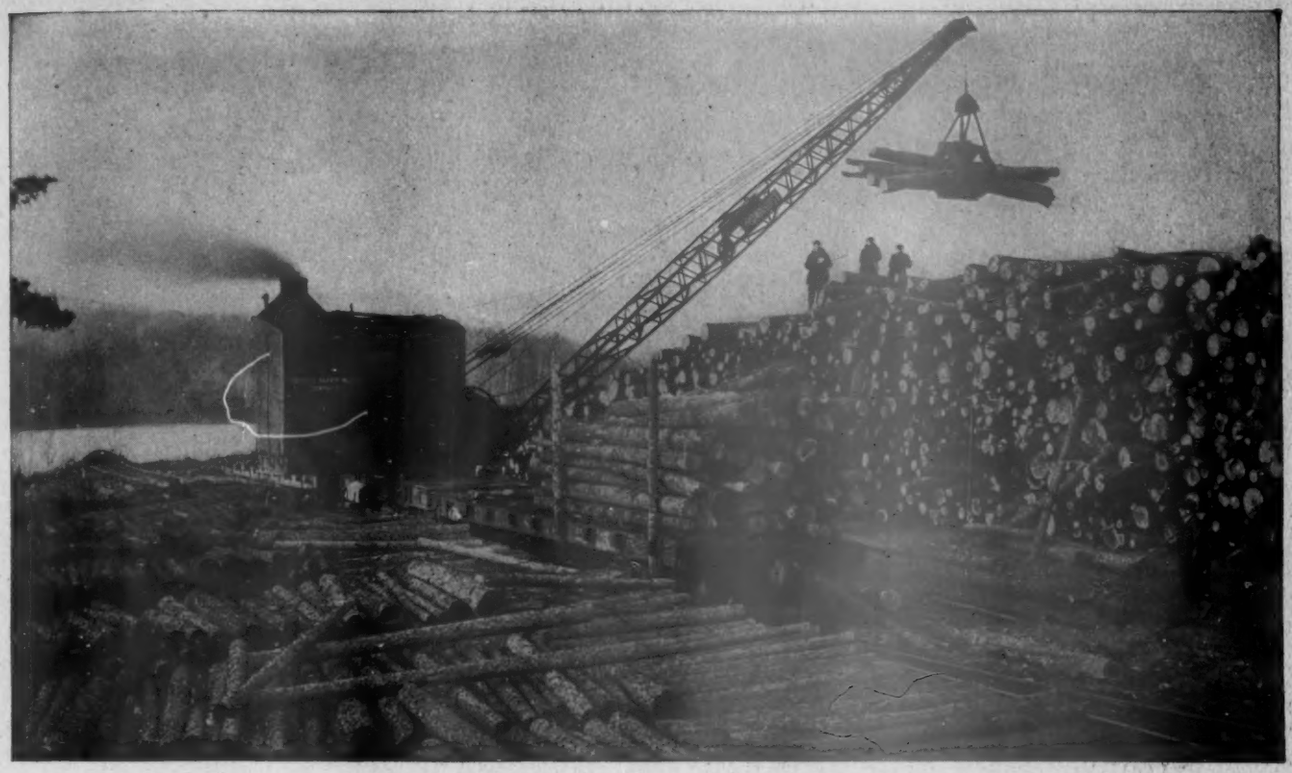

Increased handling capacity at one half the cost

To double your handling capacity and at the same time cut the unit cost in half is certainly worth while. The Brownhoist locomotive crane shown above is doing this at the paper mills where it is working. This crane handles 85 thousand feet of timber per day at a cost of 70 cents per thousand. This is against 45 thousand feet at a cost of $1.48 per thousand under the former method.

In addition to the speed and low cost of upkeep of Brownhoist cranes their great flexibility should be considered. Practically all kinds of materials can be handled anywhere as Brownhoists are made to operate on traction wheels or creeper trucks as well as railroad trucks. And the saving of handling materials by locomotive crane is usually as great or greater than the above.

Catalog K shows many types of Brownhoist cranes working in different industries. If you have any handling problems you will be interested in seeing how some Brownhoist owners are solving theirs. Write us. The knowledge of 40 years of crane building is at your service.

The Brown Hoisting Machinery Co. **Cleveland, Ohio**
Branch Offices, New York, Pittsburgh, Chicago, San Francisco and New Orleans

BROWNHOIST

DEDICATED TO QUALITY SINCE 1880

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Train operation by SIGNAL INDICATION does not require trains to stop or slow down

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Swissvale, Pennsylvania

GENERAL RAILWAY SIGNAL COMPANY
Rochester, New York

FEDERAL SIGNAL COMPANY
Albany, New York

HALL SWITCH & SIGNAL COMPANY
Garwood, New Jersey

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